VOLVME VI MARCH 1897 No. 3

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

ROGERS & MANSON,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3 50 per year

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Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

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THE BRICKBUILDER is published the 20th of each month.

NOT long ago there occurred in this city one of those lamentable accidents which are of unfortunately only too frequent occurrence in our large cities, and which, in nearly every case, are so needless and could apparently have been so easily prevented that it is hard to have any toleration for the conditions which directly or indirectly lead up to them. In the Everett School, as the pupils were being dismissed, smoke was seen issuing from one of the rooms and an alarm for fire was raised, with the result that in their blind, unreasoning haste to escape from a possible danger, a panic seized the children and they were crowded together at the foot of the stairs leading to an inadequate exit to such an extent that many of them were badly injured, and it seemed for awhile as if very serious results would follow. The fire proved to be confined to a waste-basket, and was promptly extinguished by one of the teachers, but the occurrence itself, coupled with the fact that the schoolhouse is in no sense modern in its construction, ought to be the means of arousing a more decided public sentiment which would compel municipal authorities to adopt a better and more secure construction for every schoolhouse, no matter where located, or under what surroundings. There is no excuse in these days for the existence of a schoolhouse which under even the most extreme cases is liable to destruction by fire. If the Everett School had been built according to modern methods, with terra-cotta floors, steel beams, solid furrings, and as far as possible a total absence of wood, it is quite within the bounds of possibility that the pupils might even then have been seized with a panic, and quite as much harm might possibly have ensued; but the moral influence upon the children of knowing that they are in a fire-proof building would naturally tend to lessen their liability of becoming excited upon an alarm of fire, while the chances are that if our municipal authorities should insist on all occasions upon a fire-proof construction, it would mean as a consequence more care devoted to arrangement of the schoolhouse, with the probability that better staircases and better exits would be provided and the likelihood of any occurrence such as we have cited would thereby be greatly lessened. It is no excuse to say that the Everett Schoolhouse was provided with fire-escapes. It has been said with perfect truth that only a person of mature mind and well-balanced head is competent to successfully descend even our best constructed external fire-escapes, and children are as likely to meet death on an iron fire-escape attached to the exterior of a building as they are to be overcome by the conflagration within. We do not by this imply that fire-escapes should be omitted; on the contrary, they should be provided, but on a much more ample and secure scale than is adopted at present, and instead of being aerial balconies perched on the exterior walls, they should consist of thoroughly fire-proof stairs enclosed in brick walls, with the access to each story cut off by self-closing fire-proof doors, the landings being of sufficient size to accommodate the greatest number of pupils that might use the stairs.

The fire-proofing of schoolhouses is a point which cannot be too strongly insisted upon. The trend of modern thought is entirely in this direction, and in our larger cities nearly all of the recent schoolhouses have been constructed on fire-proof lines. A few years ago the so-called slow-burning construction was advocated for schoolhouse floors, and a number of very fine buildings have been erected in accordance with this system. But however slow the combustion may be, it remains a fact that wood in any form is in no sense fire-proof, and that though the wooden beams may burn for quite a while without actually failing, it takes a very little wood to make a deal of smoke, and the moral effect on the pupils is what is to be most carefully considered rather than the ultimate resistance long after the building itself is uninhabitable. Wood in any form should be seduously avoided. With the floors constructed of steel beams and terra-cotta blocks, with mosaic or terrazzo finish for the floor surfaces throughout, with plastering applied directly to the masonry, and all partitions of terra-cotta or brick, a schoolhouse would be more durable, easier to keep warm in winter and cool in summer, would cost less for repairs, and the moral influence it would exert upon the students would in a very short time be such as to give them sufficient confidence to see a blaze start in one room without necessarily rushing panic-stricken to the nearest exit. It is contrary to all experience, contrary to the best interests of the community, and in the long run contrary to true economy, to build a schoolhouse with wooden floor construction; while as for schoolhouses constructed entirely of wood, they ought not to be tolerated anywhere, and the use of such where they exist ought to be immediately discontinued by the public authorities.

In this connection we regret to note the report that one of our neighboring cities is about to commence the erection of a Latin high school, costing upwards of $200,000, in which the entire floor construction is to be of ordinary narrow wooden beams, and in which the partitions, though mostly of brick, are carried only to the ceiling of the upper story, leaving a large roof space undivided by brick walls. This is so fundamentally wrong that we can only hope our information may be incorrect, or that the authorities in charge may substitute steel and terra-cotta before it is too late. The introduction

of so-called fire-proof paper between the upper and under floor boards is too insignificant a protection to be even considered. We repeat that the danger in a schoolhouse lies not so much in the total destruction of the edifice as in the possible destruction of life ensuing from a panic on the part of the pupils. The life of a single boy or girl is worth too much to be put at a risk on account of false economy, and so long as there is wood used in the construction of a schoolhouse, just so long are we liable to a recurrence of disasters similar to that in the Everett School; and until the parents can feel that their children are attending school under conditions abreast with the most intelligent thought upon the subject, just so long our school committees will continually fail to meet and properly provide for the fulfilment of a manifest duty.

THE PALAZZO FAVA, BOLOGNA.—PLATE 32.

THE Palazzo Fava is one of the largest and finest palaces in Bologna. Its finely proportioned brick façade of two stories carried on a graceful arcade is decorated with delicate red terra-cotta ornamentation around the windows and arches, and a strong cornicione at the top. As in most Bolognese buildings, the upper stories are carried out to the curb line, the ground floor being arcaded to form a covered sidewalk. The mullion columns of many of the windows have been cut away to make room for modern window frames, but several are left intact and are among the most interesting in Bologna. Inside there is a handsome court, the upper stories of which on one side are carried on handsome Renaissance corbels. The columns both of the court and outer arcade are built of rounded brick with carved stone capitals.

PERSONAL AND CLUB NEWS.

THE Tenth Annual Exhibition of the Chicago Architectural Club opens at the Art Institute, Tuesday evening, March 23.

A. WARREN GOULD, architect, Boston, has removed from the John Hancock Building to 2 A Beacon Street.

A. W. PUTNAM, architect, Dayton, O., has formed a copartnership with Frank L. Sutter, the firm name being Sutter & Putnam. Offices, Louis Block, Dayton, O.

AT the Chicago Architectural Club, on the evening of February 26, Mr. Hugh M. Garden read a paper on "Style," prepared by Mr. John W. Root for the club ten years ago.

On the evening of March 8, "Bohemian night" was observed, Messrs. Herbert Edmund Hewitt, Harry Dodge Jenkins, and E. Greble Killen being the hosts.

Monday evening, March 22, was Ladies' Night at the club, a reception being tendered the lady members of the Ceramic Club, who in turn served refreshments during the evening.

THE regular meeting of the New Jersey Society of Architects was held on March 12, at the Board of Trade Rooms, Newark. All sections of the State were well represented, and subjects of general interest were discussed. Three new members were added, Messrs. Brouse, Arend, and Poland, all from Trenton.

The entertainment committee announced that the annual banquet would probably be held in April. The association has permanently engaged the Board of Trade Rooms as a meeting place. Mr. John H. Post was elected to fill a vacancy in the trustees. A committee to obtain, by competition, an association seal, was appointed.

SATURDAY night, March 6, was Poster night at the St. Louis Architectural Club. There was a good collection; among them a number from Paris, exhibited by Mr. Ernst Klipstein. There were also a number of original designs by members of the club, of considerable merit. Among them one entitled "After the Symposium," *i. e.*, after returning home, by Mr. Ben Trunk. Also a very excellent one by Mr. Oscar Enders.

A number of visitors from the local chapter of the A. I. A. were entertained during the evening.

Messrs. Manny, McArdle & Ramsey acted as judges in the competition for a water tower. Mr. Ernst Helfensteller was given first place.

THE Detroit Architectural Sketch Club will hold, during the spring months, several competitions which are open to members only. The regular meetings of the club take place on Monday evenings of every week. The officers of the club are Emil Lorch, president; Geo. H. Ropes, vice-president; Edward A. Schilling, secretary; Richard Mildner, treasurer. Directors, Alex. Blumberg, W. E. N. Hunter, M. T. Wilcox.

ILLUSTRATED ADVERTISEMENTS.

THE New York Architectural Terra-Cotta Company send for illustration the upper portion of tower on Grace Church Mission Buildings, East 14th Street, New York City. Messrs. Barney & Chapman were the architects.

Trinity Memorial Church, Binghamton, N. Y., Lacy & Bartoo,

architects, is shown in the advertisement of Charles T. Harris, Lessee, page xxvi.

The Synagogue at New Haven, Conn., Brunner & Tryon, architects, is shown in the advertisement of the New Jersey Terra-Cotta Company, page ix.

The New Central High School Building, at Detroit, Malcomson & Higginbotham, architects, is illustrated in the advertisement of J. B. Prescott & Son, page xxxvi.

Spanish Brick and Tile Work. V.

BY C. H. BLACKALL.

THE picturesque qualities of Spanish architecture are due in no inconsiderable degree to the effect of the tiling which is used throughout nearly the whole of the peninsula for covering the roofs. Tile roofs of the same general description are found to greater or less extent throughout Italy, and in a few cases, in other parts of Europe; still the semi-cylindrical form of the dull, unglazed tile is more generally associated with Spanish work than with that of any other country, and if not a direct development of Spanish thought, it has certainly found a very large application in Spanish construction. The fringed, scalloped effect produced along the eaves by the use of these tiles is a very pleasing break in the sky line of a building which aims to be picturesque, and the color, which is almost invariably of a light red, adds a great deal to the effect. Tile roofs are used indiscriminately upon all classes of buildings. The illustration of the Antigua, at Valladolid, shows the picturesque effect of these tile roofs in a very striking degree, and the combination of the strong tones of the burnt clay with the clear, tawny shades of the stone, and the deep, rich purple shadows which are always a part of Spanish buildings, give a delightful charm to this old structure, and though the walls are themselves of stone, the terra-cotta plays a very considerable part in the effect. The lower roofs are covered with the semi-cylindrical tiles, and the view shows a very good general average of the way in which these roofs look after they have been repaired a few times. The tiles themselves are quite soft, so much so that in walking over a roof one is very apt to break a tile at nearly every step; but in Spain, where the rains are neither copious nor long continued, the easy-going inhabitants do not seem to consider this as a great calamity, and besides, it is so easy to patch one of these roofs by simply inserting a tile at intervals that the break is soon remedied. So far as I have been able to discover, such a thing as flashing is little known, and the tiles, after being carried up from the eaves in a more or less direct manner to the side walls or the apex of the roof, are literally swathed in good cement mortar, and if the side walls are to be stuccoed the cementing is carried up on the walls, so that to judge by external appearance these roofs, though very irregular and unworkmanlike in appearance, answer every purpose of protection. The very irregularity, which from a utilitarian point of view might be deplored, is an added element of charm to the artist, and the scalloped eaves throw long, irregularly fringed shadows on the walls below in a manner which would be impossible with any other construction. The tower of the Antigua itself is covered with flat tiles, laid in much the same manner as our slate.

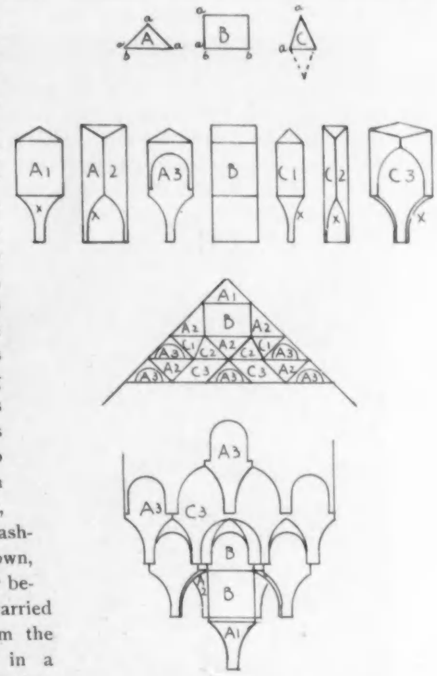
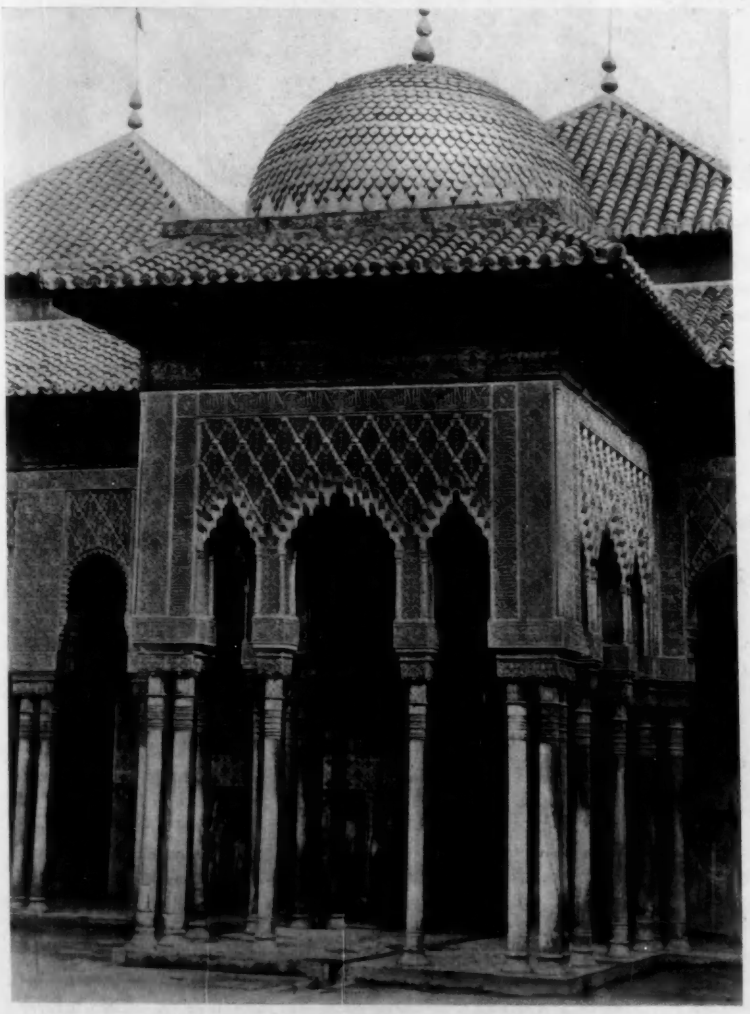


DIAGRAM SHOWING COMPOSITION OF STALACTITE WORK.



PORCH OF COURT OF LIONS, ALHAMBRA.

The porch of the Court of the Lions is an admirable example of what is done with the Spanish roofing tiles. Of course this roof has been thoroughly restored and repaired, and as the buildings are not in actual use and are subjected to a careful oversight, these tiled roofs have a finished, workmanlike appearance which is, on the whole, rather un-Spanish. The usual experience is to find the tiles so broken and patched that the surface is very much cut up and has a texture-like effect which is eminently picturesque, even if not a sign of first-class repair. A narrow band of colored tile is introduced below the base of the dome immediately over the eave tiles, and is capped by a row of the peculiar cresting tiles which are so often found in Moorish work, with a zigzag palm-leaf pattern. The effect of the vivid color interposed between the two masses of dull tilework is very striking and effective.

The view of Toledo from the Alcazar consists principally of roofs, and illustrates the various ways in which a simple tile unit can be used on different slopes and under different circumstances. The secret of the durability of a roof of this kind, of course, lies in the fact that there are no surfaces for the water to remain in, there is no snow and ice to work under the tiles, and cement is used very

liberally throughout. Tiling of this description has been manufactured to a certain extent in this country, but has never met thus far with the encouragement which it deserves. Our climate is, of course, against it to a considerable extent, but climatic disturbances can be provided for, and there seems to be no good reason why we should not avail ourselves of this excellent aid in general color treatment of a building.

TOLEDO FROM THE ALCAZAR.

The Collegiata at Toro is roofed entirely with semi-cylindrical tiles. The roof has stood so long, and has been repaired so often, that it is at present in a most delightfully artistic state of delapidation, and when I visited the church a few years ago and had occasion to walk across the roof to measure the tower, I found the tiles were so friable that two or three of them would crush with every step I took. This did not seem to at all alarm the custodian who accompanied me, and he seemed to think a few broken tiles more or less a very slight matter easily obviated by a few trowelsful of mortar.

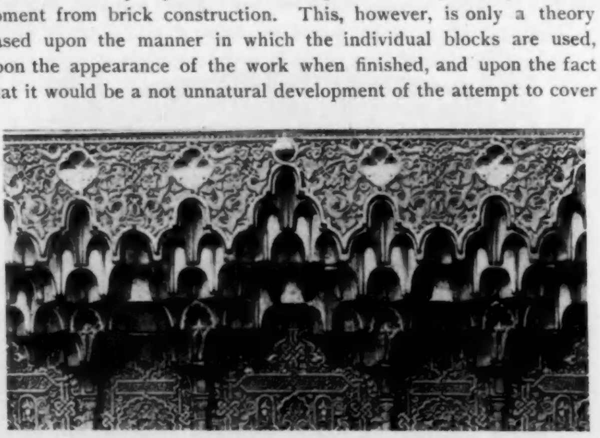
THE COLLEGIATA, TORO.

In the south of Spain along the Mediterranean coast, where the Moorish element has been most marked in its influence, there are several very interesting examples of enameled or slightly glazed roofing tiles, usually flat rather than semi-cylindrical, and in some cases worked out in color. The tiles in this part of the country are also very much darker red than those in the north, and are made of much stronger material.

There is a species of decorative treatment which is peculiar to Moorish work, and in fact has been used by no other race. It is the decoration of vaulted surfaces forming what is known as the stalactite vault. The illustration from the Alhambra will show the appearance of the work. This same treatment is often carried entirely across quite large rooms, forming a delightfully complex ceiling, which at first sight has the appearance of a maze of frost work, though closer examination shows it is constructed strictly upon mathematical principles. It is composed of numerous prisms of plaster which are united by their contiguous lateral surfaces, there being seven different forms of blocks proceeding from three primary figures in plan. They are, by reference to the accompanying diagram, the right angle triangle *A*,

the rectangle *B*, and the isosceles triangle *C*. In these the sides *aa* are equal, *ba–bb*, and the vertical angle of *C* is the same as the lesser angles in *A*, or 45 degs. The figure *B* has one form in section, the figure *A* three, and the figure *C* three, the third figure, *C*3, being a rhomboid formed by the double isosceles triangle. The curves marked *x* of the several pieces are similar. By this it will be seen that a piece can be combined with any one of the others by either of its sides, thus rendering the blocks susceptible of combinations as various as the melodies which may be produced from the seven notes of the musical scale. So far as I know, this kind of work has never been successfully copied outside of Spain. It is probably a development from brick construction. This, however, is only a theory based upon the manner in which the individual blocks are used, upon the appearance of the work when finished, and upon the fact that it would be a not unnatural development of the attempt to cover a room with a brick vault without the use of centering. In the Moorish examples the blocks are usually of plaster and are, of course, set in fresh plaster of Paris. There is no reason why a similar construction could not be applied to terra-cotta or molded brick with most interesting results. A very few patterns would suffice to answer for a great variety of designs, and with a little intelligent oversight a vaulting of this kind could be put up for moderate spans without the need of any centering, using a very quick-setting cement, as when once in place the blocks would key together thoroughly.

LA ANTIGUA, VALLADOLID.



STALACTITE WORK FROM THE ALHAMBRA.

Brick Vaults Built Without Centers.

Translated from the "*Anales de la Construccion y de la Industria*."

BY A. C. MUNOZ.

(*Concluded.*)

IF the space to be vaulted is very long, it is customary to divide it into nearly square bays, by means of arches built with centers either by the ordinary method or by that of vertical leaves. In this latter case generally only the middle leaf is made vertical, while the other leaves are built in pairs on both sides of the first, and increasing their inclination in each succeeding leaf until the desired inclination is reached. The vault is then completed as explained above.

By whatever method these dividing arches are built, the construction of the vault must proceed from both sides simultaneously, so that the thrusts will neutralize each other.

These vaults, as well as those of vertical leaves, may vary in thickness. If the thickness is equal to the length of a brick, the bricks may be laid as shown on Figs. 10 and 11. If the thickness is one and a half bricks, they may be laid as shown in Figs. 12 and 13. The vault may also be built in separate concentric rings, which method is preferable when the thickness exceeds the length of the brick, for the reason that the joints do not then open so much at the extrados, and further, the labor of filling the joints a b c (Figs. 12 and 13) with chips of stone or brick is avoided. The lime from Badajoz is of very good quality, and when used in making the mortar, the inclination of the leaves is generally increased beyond 45 degs., which is the limit for ordinary mortar.

In Extremadura most vaults are constructed in the manner last described, and are used in wells, cellars, basement rooms, and in farmhouses in which the upper floors are used for granaries. They are made more or less decorative by varying their forms, etc.

The advantages of being able to build vaults with ordinary mortars and without the use of centers are so obvious that it is not necessary to enumerate them.

GROINED AND CLOISTERED VAULTS.

The construction explained in the last chapter may be applied to a groined vault as follows:—

Let a, b, c, d (Fig. 14) be the space to be vaulted; as in the previous cases, grooves determining the curvature of the intrados are cut in the walls; then the corners a, a′ a″ a‴, b, b′ b″ b‴, c, c′ c″ c‴, d, d′ d″ d‴ are first built by laying the bricks as for an ordinary vault and until their faces reach an angle of 38 to 45 degs. From this point the construction is changed. To do the work properly four bricklayers are needed, who, placing themselves each in front of one of the walls respectively, fill in the spaces a′ a″ e and c‴ c″ e, a‴ a″ e′ and b″ b‴ e′, b′ b″ e″ and d′ d″ e″, d″ d‴ e‴ and c′ c″ e‴, setting the bricks in courses as shown by a″ e′ b″, b″ e″ d″, etc. This construction is carried on until the vault is closed, each mason building his portion as if it was a barrel vault, and when near the vertex, when the workmen would interfere with each other, the construction is carried on from the outside. Of course, at the groins the bricks have to be cut, and care should be taken to well bond the bricks which form the groins.

The construction is guided by two strings stretched between the vertices of opposite arches, as e e″, e′e‴ (Fig. 14), marking the highest points of the vault, and by five plumb lines, to determine the plane of the groins; one at C (Fig. 14, Plan), the intersection of the diagonals; the other four also on the diagonals but near the springing points, as at a a″ b″ c″ d″. The plumb lines of opposite angles together with the one at the vertex determine the plane of the corresponding groin, the curvature of which is generally given by the eye. This requires skillful workmen, and to facilitate the work the lightest kind of frames having the desired curvature may be used, and thus obviate the irregular groins which are very common in this kind of vaults.

In the construction of groined vaults of this kind for a factory recently built in Badajoz, the engineer determined the curvature of

the groins by using four strings, which, being stretched in pairs from opposite points of the head arches, and in the same horizontal plane, were thus elements of the barrel forming the vault, and therefore the intersection of these strings were points of the groins. By increasing the number of strings great accuracy may be obtained in determining the curvature of the groins.

CLOISTERED VAULTS.

The construction of this kind of vault is very similar to that of a groined vault.

Suppose a b c d (Fig. 15) to be the space to be vaulted. Having cut grooves on the walls determining the curvature of the vault and beginning at the four corners simultaneously, the portions a p e-p c f and b g q-d h q are built first. Then between these, the portions i e r-r g o and l f s-s v h are built, after which the other courses are similarly built in alternating series, as i k l m, o n v t and k w x n-y m t z.

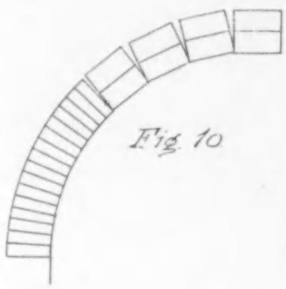


Fig. 10

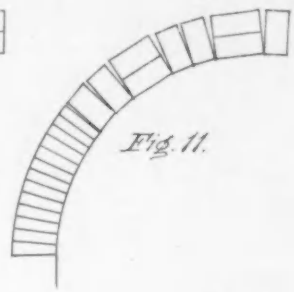


Fig. 11.

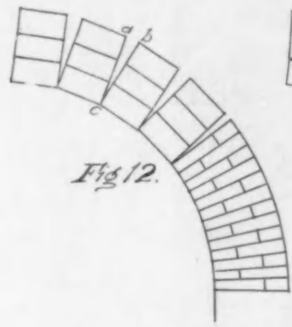


Fig. 12.

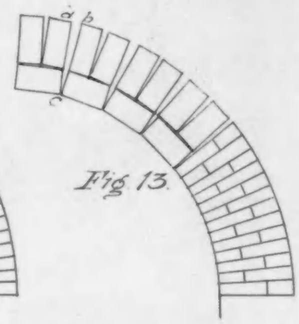


Fig. 13.

To close the vault the bricks are cut to a wedge shape, as the key of the vault is a truncated pyramid.

The construction is guided by a straight edge M-N placed between opposite walls at their middle points and above the apex of the vault, and by two strings p-q and r-s stretched between the vertices of the springing arches a r b-c s d and a p c-b q d. Their points of intersection V, which marks the vertex of the vault, may be made higher or lower by means of the string V'-j attached to the middle of the straight edge M-N, and according to the desired camber.

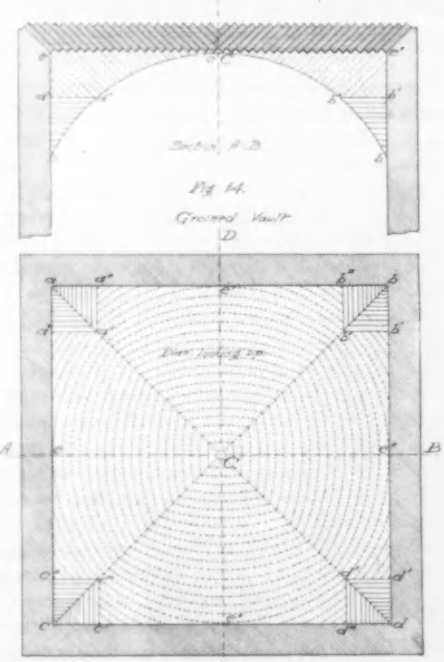


Fig. 14.
Groined Vault

The two greatest advantages of vaults built without centers are the rapidity of their construction and their small cost. Below is given the average cost per square meter, in Spain, of a vault 14 c. m. thick, as deduced from several examples.

0.20 day mason's work at 60 cents	$ .12
0.40 day mason's assistant's work at 30 cents	.14
70 bricks at $4.50 per 1,000	.31
0.038 c. m. ordinary mortar	.10
10 liters water	.02
Stone for wedges, wear and tear of tools, etc.	.07
Total cost per square meter	$ .76

Groined and cloistered vaults cost somewhat more on account of the greater difficulty in their execution, but with skilled workmen it is safe to say that the cost per square meter would not exceed 80 cents. Comparing these prices with the cost of a center in that part of Spain, it will be found that in most cases the center costs more than the vault.

The following examples will prove the durability and resistance of vaults built as described above.

Within the precincts of the castle of Badajoz there is an old ruined building called the house of the Zapatas, which was purchased in the year 1779 to be used for barracks. All the roofs, the floors, and most of the walls are now destroyed, but a portion remains 13.50 m. long by 5.50 m. wide, covered by a barrel vault which has been preserved intact, notwithstanding the long time which it has been exposed to the weather. This vault has a uniform

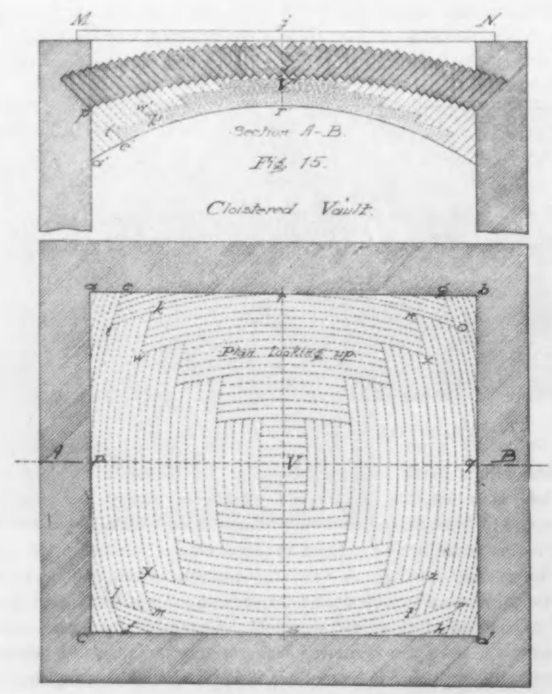


Fig. 15.
Cloistered Vault.

thickness of 0.14 m., and is formed by a single thickness of brick. The backing is of masonry and 0.28 m. thick. The springing line is 3.50 m. above the floor, the wall being 1 m. in thickness, while the thickness of the head walls, which are of adobe, is 0.84 m.

In the casemate to the left-hand side of the bastion of Santiago, in the same castle, there are six vaults; one of them is a barrel vault consisting of three sets of superposed rings of curvilinear rows, the bricks in each row being placed with the ends tangent to the curve of intersection of the intrados with a plane forming an angle of 50 degs. with the horizon. The other five are segmental barrel vaults with four sets of superposed rings; the three first sets of rings are laid as in the former vault, with their ends tangent to the curve of the intrados, while in the last or outer ring the faces of the bricks are the tangent ones. The thickness of the vault is 0.90 m. about 3.5 times the length of the bricks; the springing line is 1 m. above the floor with walls 1.70 m. thick, all of ordinary masonry. The vaults have a backing of rammed earth 1.10 m. deep at the crown; over this the upper batteries of the fort are placed. These vaults were built in 1866, and are in very good state of preservation.

In the Normal School a cloistered vault was built in 1866 and has the following dimensions: Span, 7.90 m.; camber of springing arch, 1 m.; height of crown above top of springing arch, .30 m.; thickness of vault, 0.14 m.; thickness of walls, 0.84 m.

In the barracks of San Francisco and military hospital of the same city all the rooms on the ground floor have vaults executed without centers, the rooms in the first floor being used as dormitories for the troops and as hospital wards. These vaults vary in dimensions and in shape; some date from the time of the convent which formerly occupied the site, and others were built between 1853 and 1856. Among these last the most noteworthy of all is a segmental barrel vault 20 m. long, 8.80 m. clear span, and 0.28 m. thick, the springing line is 3.20 m. above the floor and the walls 0.80 m. thick.

In Merida there are many vaults of this kind, some built before the sixteenth century, well preserved; and in those which have been neglected and that the action of time is slowly destroying, the cracks have appeared as one would expect, considering the manner in which the forces act in these vaults. In the old convent of Santo Domingo, in the same city, there is a groined vault in which one of the walls has been destroyed and only the portion of the wall that transmitted strains to that wall have fallen in.

The following fact is worthy of notice: in 1876 the Guadiana River overflowed its banks, inundating the surrounding country and the farmhouses in the neighborhood. In one of these, as in most of them, the ground floor rooms had vaults as those described, the vaults being loaded with grain. The ground floor of this farmhouse consists of four sets of chambers around a central court and forming a rectangle. The main suite, more than 40 m. in length and divided by a few partitions, is covered by two parallel barrel vaults 4 m. span; the vaults are 0.28 m. thick at the springing and 0.14 m. at the crown; the outer walls are 0.84 m. and the central wall between the two vaults was for the greater part of its length built of mold and 0.56 m. thick, strengthened by a few stone quoins and by the stone jambs and lintels of the doorways. The water completely undermined and destroyed the mold, leaving the vaults supported only by the stone quoins and by the stone jambs and lintels, and a large crack started between the two vaults not far from the springing line. To repair the vault a new wall of brick, laid without mortar in order to avoid shrinkage, was built in place of the mold wall. The crack was then filled, and soon afterwards the vault was again loaded with grain and has ever since been in perfect condition. The vaults had been built in 1840. The head wall of one of the vaults was also damaged and two small cracks appeared, separating from the rest of the vault that portion which exerts a thrust on the head wall. After repairing the wall and filling the cracks the latter have not separated.

These examples speak for themselves and sufficiently prove the strength and durability of vaults as built in the province of Extremadura.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

(*Continued.*)

PASSING from the construction and manipulation which experience has thus far proved most advantageous in terra-cotta columns, we now proceed to a consideration of the work commonly resting upon them. The introduction of iron as an auxiliary support has been suggested in the examples already given; and in those that are to follow, a free use will be made of it wherever necessary or expedient. We are aware of the objections that have been urged against the principle of composite construction, such as we now propose to discuss, but they are all of a purely academic kind, and may be put to rest without extended argument. A bare recital of the stubborn facts of every-day practise, in which iron and steel are being so extensively used to supplement or displace other materials, furnishes a conclusive answer. There is no inherent antagonism between these two materials, which in their natural state are closely allied.

We are willing to admit the scarcity of precedents for the use of iron in buildings of antiquity, but it will not be denied that the present generation of builders are doing their share to supply that deficiency on behalf of posterity. Whether posterity will approve of all that is being done for it, is, of course, an open question, and one which must await an answer from that inexorable tribunal. Meanwhile we shall be content to stand by the assertion, that a material of practical utility, however new, or a new way of using such a one to advantage, however old, should not be allowed to go begging through lack of a precedent. Let them all have a trial, free from trammels that are merely traditional, and in so far as they survive the test of service, the innovation of to-day will become the custom of to-morrow, with a good chance of being cited as a precedent on

FIG. 15.

the following day. To deny the subsidiary use of iron, as a partial support in terra-cotta construction, when almost everything in the building is in some measure dependent upon it — when in fact the fabric of the building itself is often largely composed of it, would indeed be "straining at a gnat and swallowing a camel."

The constructors of past ages did not have the superabundance of iron and steel, or the means of producing it which we possess. Wren, most scientific of constructors, made the best possible use of the scanty supply at his disposal, when he encompassed the dome of St. Paul's with four tiers of chain bond, wisely inserted in the masonry. As a further precaution, a complete ring of bar iron,

FIG. 16.

riveted together in short segments, was sunk into the stone gallery behind the parapet, and to make doubly sure, run with lead, instead of being bedded with mortar. Unlike us, he did not have Portland cement in which to set his Portland stone; nor yet a catalogue of rolled sections at his elbow, from which to select the shape, size, and weight best suited to the particular work on which he happened to be engaged. What use he would have made of these, we are at liberty to infer from the skillful way in which he applied the meager resources at his command. Of one thing we may be certain; he would not have used wood,— not even oak of English growth, and of which the "wooden walls" were built, until retired in favor of armor plate,— in the framework of the outer dome. But with him, as with all his predecessors, the supply of iron was limited, its cost relatively high, and the size of the forgings no more than could be hammered into shape, or welded on an anvil. So far, however, as it was available, they did not hesitate to employ it in connection with both wood and stone, and had they possessed half our facilities for the production of iron and steel, they would certainly have turned the product to good account. Possessing these serviceable materials we must be at liberty to use them, in an age of electicism, of which it may be said, that sufficient for the day are the resources thereof. Like many other things in the affairs of life, the use of iron as an ally to terra-cotta becomes censurable, only when it is abused, by being applied in the wrong place, or in an injudicious manner, and (as often happens) when no extraneous support is required. On the other hand, the converse of all these furnishes an unanswerable vindication of the legitimate use of both materials.

The availability of these resources being granted, it is part of our self-imposed task to show in what way the best possible use may be made of them, under various conditions. Some of these conditions are unalterably fixed; and may as well be frankly accepted as such, without wasting words on theories no better than a spider's web, as to "what might have been." Others again are so variable as to be considered in the light of an unknown quantity, until they assume definite shape. These must be met; if not by existing methods, then by special devices; or by the readjustment of those with the practise of which we have become somewhat familiar. There are, however, other conditions, — and they by no means the least important — which are entirely of *our own making*. It is with these that we propose chiefly to deal. And, as it is but a new reading of an old axiom to say in this connection that "example is better than precept," we shall give "line upon line"; backed up in most cases by what some idealist has been good enough to term "the brutal fidelity of a photograph."

Beginning in each case with the more elementary problems of the class to which they belong, we shall in due time deal wlth others of a sufficiently complex character, most of which will be from work actually done. A simple portico having but little projection from face of building is shown in section at Fig. 15. The maximum distance between columns being about 9 ft., the necessary support is supplied by two 5 in. channels placed back to back, and bolted together at intervals of 4 ft., with just enough room to receive the ¾ in. hangers; which, passing between them, take the place of separators. The soffit blocks are made in lengths of 1 ft. 10 ins., with two hangers placed 3 ins. from the ends. The ¾ in. rod having been inserted in the hole, which passes longitudinally through each piece, the chambers are then filled with concrete before being set in position. A level staging should be erected in line with top surface of abacus, on which to rest the blocks. The ¼ in. rebate left in the ends to form a receptacle for the mortar, and each block being pressed against the preceding one, a sufficient body of mortar will be retained securely between the ends of the blocks, though the vertical joint need not appear more than three sixteenths of an inch on face of the work when pointed up. The two channels having an independent bearing on each capital, the hangers may all be adjusted to requisite tension by nut and washer until the whole architrave is in line. When a slightly wider soffit has to be suspended, that may be done by means of an I beam of sufficient weight, instead of the two channels. A plate of ⅜ by 4 in. iron, with a hole in each end, is laid across the upper flange; and from it two (or if necessary, four) hangers take hold of each block in the manner indicated in alternate section.

The blocks forming frieze are molded to fit on flanges, with just enough allowance for cement, and have a continuous chase made to clear the heads of nuts, etc. The vertical joints of the inner and outer courses should alternate, and the two thicknesses may then be cramped together on top bed. The platform is made in single blocks with paneled soffit, and bonded into wall as indicated in section. These blocks contain from 9 to 12 cu. ft., which, in some situations, are certainly much larger than it would be advisable to attempt. But in the present case, their *shape* is so suitable and the other requirements so convenient, that no special difficulty was experienced in turning them out free from cracks and fairly accurate in size. Scuppers are provided in parapet panels to

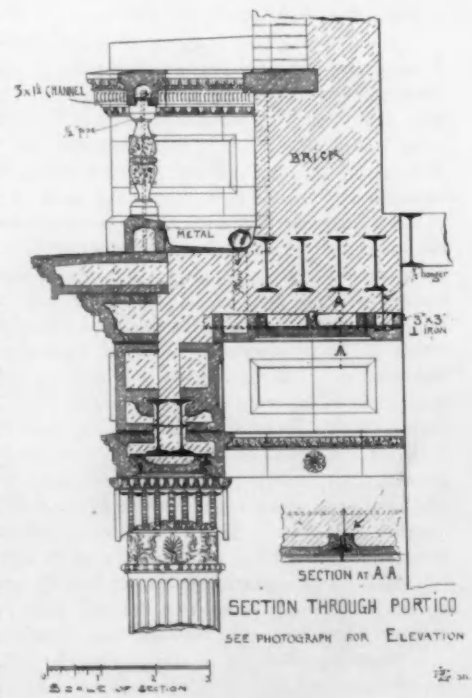


FIG. 17.

allow rain water to escape, and a raised fillet on each end of the block, prevents any of it entering the vertical joints. It will be seen from the photograph (Fig. 16) that the actual result obtained is quite presentable, and that the same principle of construction as shown in this simple example may be adopted in work of greater magnitude and importance.

In the portico shown at Fig. 17, where the span is wider, and the load to be carried much greater, a somewhat different arrangement has been made. A girder composed of two 12 in. I beams and

FIG. 18.

an 18 in. cover-plate is necessary in that case. The soffit being 2 ft. wide (which is equal to the size of column at its greatest diameter), it could not be made in single blocks with sufficient accuracy to give good alignment in the architrave on *both* faces. This member is made in three sections, two of them being molded to fit on the flanges of cover-plate, with the panel resting on rebates between them. The architrave and frieze are continued around vestibule, and the paneled ceiling is carried on the inverted tee sections inserted in joints at A.A. The space between the inner and outer blocks of frieze is backed up with brick, and the two thicknesses anchored together on top bed. Balusters are usually jointed in short sections for greater convenience of pressing. In this case they are made in two pieces with a ¾ in. hole in center for an iron rod, one end of which presses down into plinth, the other extending through channel, which has been holed to suit spacing of balusters. The ends of this channel are built into pedestals, and it but remains to set the coping to line on a good bed of cement, taking care that the vertical joints are all well filled and neatly pointed. The enclosed space behind balustrade is covered with metal, flashed into a continuous groove around plinth and graded to outlets with leader at each side of portico. So much for the anatomy of the subject; which, however needful, is usually forgotten after the components have been assembled. There are, of course, several ways in which an entablature of this kind could have been supported, and some of them will be embodied in subsequent examples. This one, however, was found to answer its intended purpose and was favorably spoken of by the men who set the work, whom, it would seem, did their share of it with more than ordinary intelligence. Among other evidences of care and forethought may be noted the slight camber over the opening; just sufficient to correct the optical illusion, which makes a perfectly straight architrave appear to sag. In Fig. 18 we see the skeleton clothed, and are better able to judge whether or no — in a materialistic sense at least — "the end justifies the means."

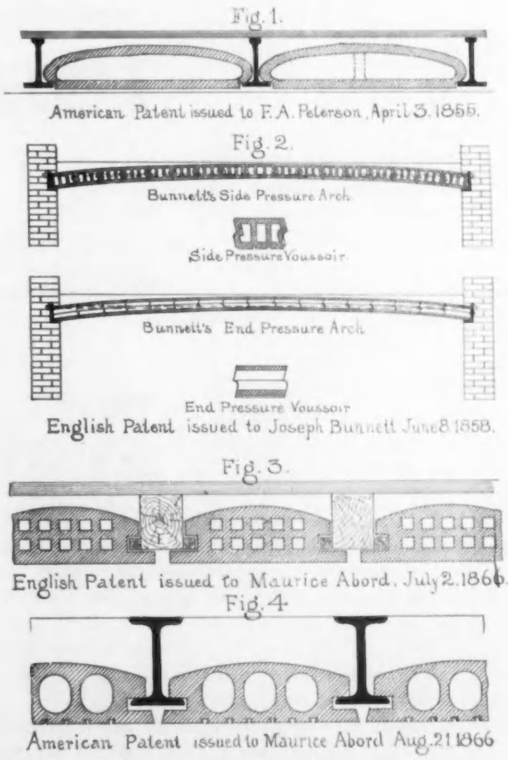
Fire-proofing Department.

ORIGIN AND HISTORY OF HOLLOW TILE FIRE-PROOF FLOOR CONSTRUCTION.

BY PETER B. WIGHT.

IN preparing the following notes the writer feels the necessity of offering an apology in advance for the use of the first person singular, for there does not seem to be any possible way to avoid it if this history is to be complete. In the places where this has to be done the reader will kindly bear in mind that he has no financial interest now in the matters to be referred to.

The use of brick arches for floor construction was coincident with the introduction of the manufacture of I beams into this country, and had preceded it to a certain extent; for, a few floors had been constructed before 1850 in which cast-iron I beams had been used, and in some of these the I beams had been strengthened by the insertion of a wrought-iron rod shrunk in a recess on the under side where the flanges of the I join the web. Rolled deck beams inverted had also been used for floors. In all these cases brick arches were used. I beams of the general section now employed, or double T beams, as they were sometimes called, were first rolled in France in 1853. Their introduction was generally followed in that country by the "Thausne System," which consisted of filling the space between with plaster béton reinforced by occasional iron bars. I beams were first rolled in this country by the Trenton Iron Works, in 1854, and were first used in the Cooper Institute in New York; though the beams of the first floor were made of two channels riveted together, and those of some of the upper floors were of inverted deck



beams. The first building in America in which I beams were used throughout was the brownstone Court House in City Hall Park, New York.

It is a fact, however, that hollow burned clay tiles were used in

this country as soon as I beams were rolled, though their employment cannot be considered as having been anything more than experimental. They were invented for the Cooper Institute, and used in the first story only, by Frederick A. Peterson, the architect of the building, whose name, by the way, appears among the "Founders" of the American Institute of Architects in the last printed *Proceedings*. These, according to the best evidence obtainable, were the first hollow burned clay tiles for floor construction ever designed, made, and put into a building, and the invention and introduction can be fairly claimed as American. As proof of this assertion I will add that I am in possession of the records of two important lawsuits involving the authenticity of the invention of flat hollow arches and the fire-proofing of I beams, and that the records of all inventions and publications bearing on the subject were exhaustively searched by the parties in interest for evidence affecting their respective sides. The patent taken out by F. A. Peterson, April 3, 1855, anticipates all others, and while it would in these days likely be considered impracticable, it was put in use in this one building through the perseverance of the architect, and the determined pertinacity of Peter Cooper. When a schoolboy I remember seeing the work set. When involved in a lawsuit in which it was thought necessary by my attorneys to present evidence of what was then done, I found the building in process of alterations, and was enabled not only to make drawings of the construction on the spot, but to remove some of the tiles. I found that they were all made of a semi-fire-clay and molded by hand. The following section drawing is taken from the patent issued to Peterson, and shows exactly how the floors were built. (Fig. 1.)

The drawing shows inverted deck beams; but double 3 by 6 in. channels were used, so that they were 6 ins. wide top and bottom. They were set about 2 ft. 6 ins. from centers. The bottoms of the beams were covered with cement, flush with the bottoms of the tiles. The ceilings then received two coats of plaster.

The above construction was never repeated, to my knowledge. The usual method for filling between I beams, thereafter used for many years, was with segment brick arches, and flat ceilings were obtained by furring off, in some cases with wood, and in others with iron, using corrugated iron lathing. There were some instances in which sheet iron, with very deep corrugations, and flat in form, was laid on the bottom flanges of the beams and covered with concrete. In these the ceilings were furred off for lath and plaster. I know of one instance where slabs of sandstone were set on the bottom flanges of the beams and carved with tracery patterns to form an ornamental ceiling pattern. In this the bottoms of the beams were covered with ornamental cast iron. In one building the space between beams was filled with heavy boiler plates riveted to the top, and a patent was taken out by Samuel P. Snead, of Louisville, the founder of the Snead family of iron workers, for filling between the beams with ornamental cast-iron plates. It was many years before corrugated iron arch plates were used.

Fig. 5.

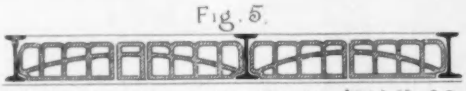
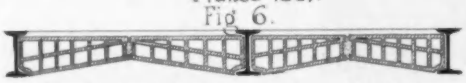


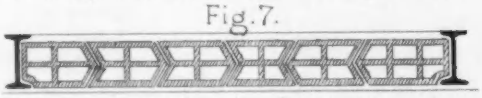
Illustration in Descriptive Pamphlet of E. Muller & Co. France 1867.

Fig. 6.



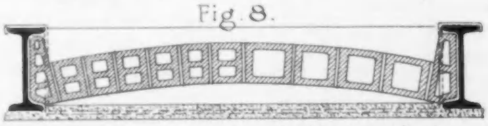
Another Form of Arch by Professor Muller, from the Gazette des Architectes Paris. 1867.

Fig. 7.



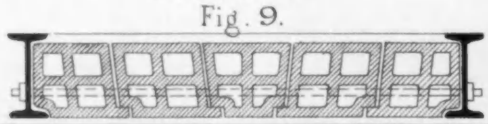
M. Verdier's flat Arch. from Illustration in the Gazette des Architectes, Paris 1867.

Fig. 8.



From Leonce Reynaud's Traite d'Architecture Paris, 1867.

Fig. 9.



Vincent Garcin's French Patent. Oct. 11. 1867.

Three years after the date of the Peterson patent, Joseph Bunnett, of Deptford, England, on June 8, 1858, took out a patent for constructing very wide span segmental arches of hollow tiles between wall plates of angle iron, connected by iron tie-rods. The Bunnett arch was shown by two sectional drawings, and in each the arch was of sufficient length to cover a moderate-sized room, and with very slight rise, so that the tie-rods were contained within the arches. One of these arches was on the side-pressure, and the other on the end-pressure plan. The tiles were described as being pressed out through dies, with hollow chambers and webs. Those for the side-pressure arches had peculiar notches on the sides, and were cut off square at the ends, while those for the end-pressure arches were of the same section, but cut off in the ends to the same section as the sides. The result was that the side-pressure arches could be set with broken joints, and the end-pressure arches so that each course could be notched into the adjoining course, thus avoiding a defect in all end-pressure arches that have lately been used so extensively. The key tile of the side-pressure arch was made with notches on both sides. In this patent we find the earliest claim for using independent voussoirs for hollow-tile arches, and the first for pressing them out through dies by machinery. It also establishes the early date of the invention of arches constructed on the end-pressure principle. The following illustration is reproduced from the drawings attached to Bunnett's patent. (Fig. 2.)

Bunnett was a well-known clay manufacturer, and brought his invention into use. I remember finding, with great surprise, a sample arch of this construction set up on a vacant lot in the rear of the temporary office of architect W. W. Boyington, at Chicago, in 1872, very shortly after the great Chicago fire. At that time several architects had temporary offices in the burned district, my own among them. But I have never heard of the Bunnett arch being used in Chicago, or elsewhere in this country. The sample was of about 12 ft. span, and with only a few inches rise, and was not more than 6 ins. thick. It must have been sent over from England in expectation that the lessons of the great fire would result in the erection of many fire-proof buildings. But this was not the case. There was no time to study up the subject. The most that was done at first was to greatly increase the thickness of brick walls between buildings, to which architects and owners then agreed, as a provision against the spread of fire, even before any special laws had been passed. As one of the results, the building laws of Chicago now require an average thickness for party walls in high buildings greater than those of any other large city. Another is seen in the fact that the fire records since that time show that fires in Chicago are almost invariably confined to the building in which they originate. The second great fire of 1874, which raged through frame buildings for several blocks, was stopped when it reached the new five-story brick party walls on Wabash Avenue.

Invention in this direction seems to have ceased for eight more years. The Americans were using brick floor arches, and in some cases corrugated iron; the English were using solid concrete arches, that invented by Dennett being a favorite, and the French used the plaster concrete filling, called the Thausne System. On July 2, 1866, Maurice Abord, of Buissonniers, France, took out an English patent for a solid-tile arch in one span with arched top and flat bottom, for use between wooden floor joists. He had probably previously patented it in France. But very shortly after, August 21, 1866, he took out a similar patent in the United States, in which he showed the combination of his arch brick with I beams. While his arch tile was similar in general form to that of Peterson, it differed from it in that the soffit was set much lower, and projections on the sides formed a covering or protection to the beam which he specifies as being useful in fire-proof work. This appears to be the first inven-

tion patented in which burned clay is used for the protection of the bottoms of both wooden and iron beams from fire simultaneously with the construction of flat plastered ceilings. Illustrations from but the English and American patents are here given. (Figs. 3 and 4.)

Following this invention there seems to have been a great revival of interest in the subject, though there is no evidence of Abord's invention having been put into practical use. The objection to it was the same that held against Peterson's. It was very difficult and expensive to make such large hollow tiles of clay, and not economical to set the beams close enough together to use tiles of a size within the practicable limits of manufactures of clay. But the interest in fire-proof floor constructions with hollow tiles found its expression in the French International Exposition of 1867 in many ways, and several inventions appeared which there is no record of having been patented. They are, however, described in many publications of the time. Emile Muller, professor of construction at the Central School of Arts and Manufactures, Paris, in 1867, made many inventions for floor and ceiling constructions with I beams and hollow tiles. Among these is one described and illustrated in the price-list of E. Muller & Co., called "Light hollow filling, termed plate band brick, for filling in of floors," of which I give a reproduction. (Fig. 5.)

It will be seen that he used in some cases two bricks, and in others three. In the latter the third brick acted as a key. In these there appears to be no protection for the bottom of the beams except by carrying the plaster over their surfaces. The circular shows many other kinds of hollow tiles for segment arches (in which they are arranged in voussoirs), partitions, and other purposes for which they are used to-day.

In the *Gazette des Architectes* for 1867 I find a description of some of the French exhibits of hollow tiles. Here is an illustration of another invention of Professor Muller, similar to the last described, the arches being in two pieces. (Fig. 6.)

Another interesting exhibit is thus described: "Mr. Verdier has exhibited a floor formed of hollow brick, fitting the one into the other; one of them forms the key, and those which touch the beams are of variable length, so that the joints may be broken on each row. Very little mortar suffices to unite together these bricks which are held together, so that if one takes care to bond them in setting, the soffit of the arch shows a concavity of two centimeters between the beams." (Fig. 7.)

It will be observed that this is a flat arch though built of symmetrical tiles, and is equally strong as against a weight or upward pressure. The utility of this is not apparent where the floors are only intended to carry loads on top.

In Leonce Reynaud's *Traite d'Architecture*, Paris, 1867, is a description of hollow-segment and flat-arch construction between I beams accompanied by two illustrations. The former shows the style of segment arch now in use. The latter is the first flat hollow-tile arch in voussoirs as now generally used of which there is any record, and was the invention of Vincent Garcin, who patented the same in France, Oct. 11, 1867. These two styles of beam filling arches are here shown. (Figs. 8 and 9.)

To Vincent Garcin, therefore, must be ascribed the invention of the practicable flat hollow-tile arch as now so extensively used in this country. It will be noticed that this arch still leaves the bottoms of the beams exposed, to be covered only with plastering. But it has another feature. There are projecting lugs on the bottoms of the voussoirs and corresponding recesses, as if to prevent each successive voussoir and the key from slipping down. This idea seems to have taken hold of many succeeding inventors, and several patents have been taken out in this country for similar devices, evidently without knowledge, on the part of patentees or examiners at the patent office, that they were anticipated by the Garcin patent. But the idea was not even new with Garcin, for it was anticipated by the Englishman Bunnett. The futility of all such changes from the simple form of voussoirs with straight joints was long since established.

(To be continued.)

Mortar and Concrete.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING.

(Continuation of tests made by Prof. Cecil B. Smith.)

PAPER II.

FROST TESTS.

IN a previous paper, read before the society, the writer promised to place before its members the results of certain frost tests, which were being made at that time.

They are now given, in hope that they may be of some interest to those engineers who are contemplating the building of cement mortar masonry, or cement concrete in cold weather.

Method of procedure.—The briquettes were all made in the same manner, the 1 to 1 mixtures having 18 per cent. of water, and the 3 to 1 mixtures 15 per cent., being purposely greater than the amount used in ordinary laboratory tests, so as to get the mortar softer, and resembling more closely the condition in which masons use mortar in ordinary construction, as the effect of frost may be greater on soft mortars than on dry ones.

The briquettes were all rammed into the molds in 3 layers, and the briquettes to be subjected to frost tests were immediately put

FOUR MONTH TESTS.

BRIQUETTES MADE DURING MONTH OF NOVEMBER, 1894.

Date of Exposure.	No. of Brand. (See Paper I.)	Ordinary time of setting.		Mixture.	Temperature at time of mixing.			Temp. of outside air.	Time elapsed from mixing to time of exposure.	Tensile Strength.		Remarks concerning exposed specimens.
		Initial.	Full.		Lab. air.	Water.	Materials.			Lab. Tests.	Exposed specimens.	
Nov. 14	1 old sample	6°00′	12°00′	1 to 1	59°	56°	59°	36½°	10′	321	236	All these were of natural cements. They were brought in and kept 2 or 3 hours before testing, and allowed to warm so as to drive out the frost, and insure a test not being made on a frozen specimen. There were no external signs of any effect produced by 4 months' exposure.
16	2	5°30′		1 to 1	64°	60°	64°	53°	7′	302	220	
2	2	45′	2°45′	1 to 1	65°	58°	60°	60°	10′	484	250	
1	15	1°00′	2°30′	1 to 1	65°	62°	64°	66°	10′	541	237	
			Averages		63°	59°	62°	51°	9¼′	412	236	
Nov. 5	3	5°00′	20°00′	3 to 1	68°	65°	65°	37°	12′	143	147	All these were of Portland cement. They were, when necessary, brought into the laboratory and kept there for 2 or 3 hours before being tested, so as to insure that no tests were made on frozen briquettes. No signs of the effect of frost were visible on any of the specimens.
26	4	37′	3°10′	3 to 1	64°	58°	57°	29°	7′	236	200	
27	5	1°00′	5°00′	3 to 1	61°	62°	56°	36°	9′	237	183	
28	6a	2°00′	6°30′	3 to 1	68°	64°	63°	28°	8′	222	128	
6	8	3°20′	6°30′	3 to 1	63°	59°	60°	42°	9′	172	114	
9	9	13′	2°00′	3 to 1	64°	57°	61°	32°	11′	194	182	
13	10	25′	50′	3 to 1	62°	57°	57°	35°	7′	174	176	
19	11	30′	1°0′	3 to 1	60°	55°	57°	34°	8′	153	141	
21	12	25′	3°00′	3 to 1	60°	52°	58°	39°	9′	119	102	
20	14	20′	2°30′	3 to 1	61°	54°	58°	26°	9′	131	125	
22	19	2°40′	7°40′	3 to 1	58°	54°	56°	37°	7′	253	387	
			Averages		62½°	58°	61°	34°	8⅔′	185	171	

outside on a window-sill. In a few hours, after the briquettes were frozen hard, they were removed from the molds, and left exposed on the window-sills for two, three, or four months, care being taken to keep the snow swept off so as to allow the frost to have its full effect.

The tables, given, speak for themselves, and probably each engineer will draw special conclusions of his own; the writer will only mention a few points that seem obvious to him.

I. FOUR MONTHS TESTS.

It would appear, from these tests, that it is quite safe to build masonry work in November, in Montreal climate, when the materials are mixed and exposed to the air at about the freezing point. The proportion which the strength of the frost tests bears to the submerged ones is about that which would be obtained under the most favorable circumstances. The briquettes were all firm, smooth, and hard on the surface, and although subjected to 4 months of severe frost in an exposed position, they did not seem to have been at all damaged.

II. THREE MONTHS TESTS.

These were all made in December, and the coldest days were purposely selected. Yet the only briquettes which were blown in pieces were those made from two very inert, slow-setting, poor Canadian natural cements. The two other natural cements (one Canadian, the other Belgian) were quicker setting, and stood the test well. With the Portland cements, the diminution in strength is more apparent than real, the proportion of 90 to 164, which is the average of 11 brands, is really between briquettes ¾ to ⅞ in. square, and briquettes 1 in. square, the frost specimens being weathered off.

It is reasonable, however, that a briquette 1 in. square, exposed on 3 sides to the direct action of the frost, is rather more severely tested than mortar would be if placed in a wall, even the bottoms of the briquettes resting freely on the stone window-sills were largely uninjured, and the centers of all the briquettes appeared uninjured. As a result of these experiments, the writer would feel perfectly safe in laying cement mortar in December, with Portland or active natural cements, in weather 10 to 15 degs. above zero, and in the most exposed situations, expecting in the spring, to find ¼ to ½ ins. disintegrated at exposed joints, and needing re-pointing, or better still, the pointing could be left till spring, and done once for all.

III. TWO MONTHS TESTS.

These tests were much more severe in their nature, the sand and cement were exposed for hours in the open air, in small quantities, until they were absolutely down to the temperature of the outer air, and in the cold water and salt water series the water was also exposd, until it was, in three cases, actually below the freezing point, being in a slushy condition.

These materials were put together in the laboratory, as rapidly as possible, and exposed again at once, the usual interval being about 6 minutes, and the actual temperature of the mortar just before exposure having reached about 33 or 34 degs. F., while in the hot water tests the mixture rose, on an average, to 58 or 60 degs., just before exposure, which was just about laboratory temperature.

The experiments are hardly extensive enough to be fully conclusive, being made only on 7 brands of cement, but they point clearly to the advantage of the use of salt. Those briquettes made with salt showed good strength and little injury; although made with materials, at low temperatures exposed in severe cold, they seemed to be chiefly affected only on the surface.

THREE MONTH TESTS.

BRIQUETTES MADE DURING THE MONTH OF DECEMBER, 1894.

Date of Exposure.	No. of Brand. (See Paper I.)	Ordinary time of setting. Initial.	Final.	Mixture.	Temperature at time of mixing. Lab. air.	Water.	Materials.	Temp. of outside air.	Time elapsed from mixing to time of exposure.	Tensile Strength. Lab. Test.	Exposed specimens.	Remarks concerning exposed specimens.
Dec. 26	1	6°00′	12°00′	1 to 1	62°	60°	58°	+ 7°	5′	247	0	Briquettes frozen long before set could take place, all blown to pieces by frost.
24	(old) 2	5°30′		1 to 1	60°	52°	53°	+10½°	7′	198	0	ditto
1	2	45′	2°45′	1 to 1	65°	60°	60°	+19½°	8′	190	233	Seemingly quite sound, but broke irregularly as to loads and position of fractures.
1	15	1°00′	2°30′	1 to 1	61°	56°	56°	+16°	7½′	484	311	Practically sound, some slight cracks on the surface.
Average of No. 2 and No. 15					63°	58°	58°	+18°	7¾′	337	272	
Dec. 3	3	5°00′	20°00′	3 to 1	60°	60°	56°	+17°	7′	108	101	About 1-16″ on the surface, disintegrated, the remainder quite sound.
31	4	37′	3°10′	3 to 1	60°	56°	56°	+19°	6′	204	85	ditto
31	5	1°00′	5°00′	3 to 1	48°	45°	46°	+14½°	6′	218	111	ditto
31	6a	2°00′	6°30′	3 to 1	52°	48°	49°	+ 8½°	6½′	247	47	Three of these disintegrated for 1-16″ on outside, the other two injured to the very center, average of three being (72).
8	8	3°20′	6°30′	3 to 1	69°	63°	63°	+21°	6½′	191	163	Seemed perfectly sound and solid.
10	9	13′	2°00′	3 to 1	68°	64°	64°	+14°	8′	151	113	These during a warm spell of three days remained quite soft, not setting at all; when tested, they showed a slight weathering on the top surface.
18	10	25′	50′	3 to 1	57°	53°	53°	+18½°	7½′	132	154	Seemed perfectly sound and solid.
27	11	30′	1°00′	3 to 1	70°	65°	65°	+ 7°	7′	107	59	Disintegrated for ⅛″ on top and sides, remainder solid looking.
28	12	25′	3°00′	3 to 1	61°	55°	59°	+ 9°	6′	89	23	Disintegrated for ¼″ on top and sides, remainder solid looking.
31	14	20′	2°30′	3 to 1	50°	50°	54°	− 7°	7′	131	49	ditto
29	19	2°40′	7°40′	3 to 1	65°	61°	61°	− 6°	6′	223	87	Only 1 briquette was disintegrated on the surface, but all were weak and brittle, crumbling if rubbed with the fingers.
Averages					60°	53°	54°	+10½°	6⅔′	164	90	

TWO MONTH TESTS.

(With cold water.)

BRIQUETTES MADE DURING THE MONTH OF JANUARY, 1895.

Date of Exposure.	No. of Brand. (See Paper I.)	Ordinary time of setting. Initial.	Full.	Mixture.	Temperature at time of mixing. Lab. air.	Water.	Materials.	Temp. of mixture just before exposure.	Temp. of outside air.	Time elapsed from mixing to time of exposure.	Tensile Strength. Lab. Tests.	Exposed specimens.	Remarks concerning exposed specimens.
Jan. 14	2	45′	2°45′	1 to 1	61°	32°	+19°	40°	+18°	6′	295	21	Practically all blown to pieces, the solid core of two briquettes giving 105 lbs. = 21 lbs. average.
5	15	1°00′	2°30′	1 to 1	57°	36°	+26°	38°	− 3°	6′	330	87	All the exterior blown to pieces, interior solid.
Averages					59°	34°	+22½°	39°	+ 7½°	6′	312	54	
Jan. 21	3	5°00′	20°00′	3 to 1	63°	32°	+14°	34°	+13°	6½′	86	0	All soft and crumbling. No strength at all.
24	8	3°20′	6°30′	3 to 1	57°	32°	+ 5°	36°	+ 5°	9′	214	5	Cement frozen when mixed 6′. mixed by hand, a very severe test; briquettes appeared firm on surface, but crumbled when touched.
29	9	13′	2°00′	3 to 1	60°	32°	+20°	37°	+18°	6½′	133	92	Disintegrated on top for 1-16″; remainder solid.
Feb. 5	10	25′	50′	3 to 1	55°	34°	−11°	30°	−11°	6′	145	39	This mortar frozen when mixed, mixed by hand on table, a very severe test, briquettes appeared firm on surface, but weakened all through.
Averages					59°	32½°	+ 7°	34°	+ 6°	7′	144	34	
Average of Nos. 3, 8, and 9					60°	32°	+13°	36°	+12°	7′	144	32	

TWO MONTH TESTS.

(With hot water.)

BRIQUETTES MADE DURING THE MONTH OF JANUARY, 1895.

Date of Exposure.	No. of Brand. (See Paper I.)	Ordinary time of setting. Initial.	Ordinary time of setting. Final.	Mixture.	Temperature at time of mixing. Lab. air.	Temperature at time of mixing. Water.	Temperature at time of mixing. Materials.	Temp. of mixt're just before exposure.	Temp. of outside air.	Time elapsed from mixing to time of exposure.	Tensile Strength. Lab. tests.	Tensile Strength. Exposed specimens.	REMARKS ON EXPOSED SPECIMENS.
*Jan. 18	2	45′	2°45′	1 to 1	64°	125°	33°	68°	+11°	6′	428	109	Badly blown on exterior for ⅛", but interior still solid.
5	15	1°00′	2°30′	1 to 1	57°	126°	30°	65°	+ 3°	6′	250	23	Top surface blown off for ¼", interior solid looking.
			Averages		60½°	125½°	32½°	66½°	÷ 7°	6′	339	66	
Jan. 21	3	5°00′	20°0′	3 to 1	63°	125°	18°	61°	+15°	6′	85	0	All soft and crumbling, no consistency at all.
23	8	3°20′	6°30′	3 to 1	64°	110°	20°	59°	+20°	6½′	99	47	Set very slowly in laboratory, those exposed were neither frozen nor set after 4 hours.
30	9	13′	2°00′	3 to 1	63°	119°	18°	59°	+18°	5½′	109	88	Disintegrated for about ⅛" on top, remainder solid.
Feb. 5	10	25′	50′	3 to 1	55°	115°	−11°	54°	−11°	7′	132	21	Slightly disintegrated on top, and weakened all through.
			Averages		61°	117°	+11°	58°	+10½°	6′	106	39	
	Average of Nos. 3, 8, and 9				64°	118°	+19°	60°	+18°	6′	98	45	

TWO MONTH TESTS.

(With 2 per cent. of salt in the water.)

BRIQUETTES MADE DURING THE MONTH OF JANUARY, 1895.

Date of Exposure.	No. of Brand. (See Paper I.)	Ordinary time of setting. Initial.	Ordinary time of setting. Full.	Mixture.	Temperature at time of mixing. Lab. air.	Temperature at time of mixing. Water.	Temperature at time of mixing. Materials.	Temp. of mixture just before exposure.	Temp. of outside air.	Time elapsed from mixing to time of exposure.	Tensile Strength. Lab. Test.	Tensile Strength. Exposed specimens.	REMARKS ON EXPOSED SPECIMENS.
Jan. 18	2	45′	2′45"	1 to 1	64°	32°	22°	41°	11°	6′	320	73	Blown on surface for about ⅛", interior solid.
9	15	1°00′	2°30′	1 to 1	58°	40°	9°	42°	9°	6′	280	143	Slightly blown on bottom, other fine cracks on top, otherwise solid.
			Averages		61	36°	15½°	41½°	+10°	6′	300	108	
Jan. 21	3	5°00′	20°00′	3 to 1	65°	29°	25°	39°	25°	6′	101	39	Exterior worn with loose sand, but interior hard and firm, water was slushy at time of mixing.
28	8	3°20′	6°30′	3 to 1	56°	30°	13°	30°	12°	6½′	183	224	In perfect condition, water was slushy at time of mixing.
31	9	13′	2°00′	3 to 1	57°	30°	17°	30°	19°	6′	105	92	One briquette badly affected, and others quite sound. No. 10 is not tested.
	Average of (3)				59°	30°	18°	33°	17°	6′	118	130	

NOTE.— Each test recorded in this table is the average of 5 briquettes, all briquettes rammed moderately, in 3 layers, with an iron hammer having ½" square end, and weighing about ½ lb.

On the other hand, the use of hot water does not seem to be of any advantage, particularly in Portland cements; a reason advanced by one writer for this fact was, that the bringing together of materials in a mortar, at widely divergent temperatures, exerted a prejudicial effect on the cement, hindering proper crystallization, and that the use of materials, at, as nearly as possible, the same temperatures would produce more rapid and stronger action. The effect of hot water on natural cements is not so disappointing, but does not show much increase over the strength of similar specimens made with cold water.

The general result of these experiments, to the writer's mind, points to the idea that in any weather, in winter, not extremely cold, say not lower than + 15 degs. F., masonry work can be laid with cold sand, cold cement, and cold water, provided the natural time of set of the cement is not more than 5 or 6 hours, and that by the addition of about 2 or 3 per cent. of salt to the water, the same work may be done in weather down as low as zero, which is as cold as men will work. The disintegration will not extend probably deeper than ¼ to ½ ins. — the remainder of the mass being quite sound.

By what process cement sets, after it has, in a few minutes, been frozen solid, and remains frozen for months, the writer will leave to others to explain, but set it certainly does, without ever having been thawed out.

THE ENGLISH METHOD OF BUILDING CEMENT SIDEWALKS.

EXCAVATE the ground to a depth of about 5 ins. below the finished level, and upon this lay about 1 in. thickness of cinder or gravel; upon this lay a layer of clean hard stone or other suitable material broken so as to pass through a 3 in. ring, well watered and rolled, filling up inequalities and leaving the surface about 2 ins. below the level of the footway (sidewalk). Divide into bays (sections) about 6 ft. in width with battens of soft wood, and complete each alternate bay by laying upon the stone foundation carefully prepared concrete composed of one part Portland cement, two parts coarse, clean gravel, or other suitable procurable material, passed through a 1 in. screen, and two parts clean, sharp sand, which must be well beaten or rolled into place; and before it is set a finishing coat 1 in. in thickness of a finer and richer concrete to be added and brought up to the finished surface of the footway, and well troweled and smoothed into place. This finishing coat may be composed of one part Portland cement to two parts granite chippings, three parts gravel or other suitable material which will pass through a ¼ in. sieve. As the work is finished the battens may be removed and the joints filled with fine sand. — *Carriage and Footway Construction.*

COLOR OF NATURAL CEMENT.

THE color of the manufactured cement, being due principally to the presence of a small quantity of oxide of iron and sometimes of manganese, or to the carbonates of these oxides, which for all practical purposes are conceded to be a passive ingredient in hydraulic mortar, should be a matter of indifference to consumers. In fact, the presence of a large proportion of the coloring principle, like that of any other inert substance, might be expected to have a tendency to deteriorate the quality of the mortar by diminishing the cohesive strength of the cementing substance, and, therefore, if taken into consideration at all, ought at least to direct suspicion to the darker varieties. — *Gen. Q. A. Gilmore.*

The Masons' Department.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX.

(Continued.)

FOREMEN.

THE one thing above all others which enables an individual, firm, or corporation to carry on an extensive building business is the ability to select competent and able foremen; and with the increasing complications involved in the construction of a large modern building, and the speed with which the work must be done, the duties and responsibilities which devolve on a foreman have materially increased. In truth, he must have practically all the qualities which go to make a successful master builder, differing only from his employer from the fact that he has no capital involved. When one considers the amount of time the average master builder must spend attending to the strictly financial side of his business in estimating travel and other details, it can readily be seen that the actual carrying out of a piece of work must necessarily be entrusted to a subordinate, and that upon his ability will depend to a great extent the success or failure of the undertaking.

Of the qualifications which go to make a competent foreman, the most important is an accurate and complete knowledge not only of his own particular trade, but of all others which come in connection with it; he must also be a thorough mechanic, for if he is unable to do work in the right and economical way himself, it is hardly possible that he will be able to show others how to do it.

After the mechanical skill as a requisite for a competent foreman should be placed foresight, which, although at first thought may seem to be a matter of minor importance, is, nevertheless, an essential quality. In order to have work which is done in a hurry (and very little, unfortunately, is now done in any other way) proceed smoothly, the foreman must be constantly planning ahead. He must have the method by which the work is to be carried on clearly in mind; he must see that the proper materials and sufficient in quantity are at hand when needed; and by no means least important, he must see that he has proper drawings from which to lay out the work in advance. While it must be acknowledged that many delays are caused by the lack of drawings, it must at the same time be admitted that if some one makes timely and reasonable requests of the architects the necessary drawings can be had, and the foreman is the man who should issue the reminders which are always necessary to keep such people up to time. A foreman who combines the two essential qualities of foresight and care will save his employer from much expense, and the architect from many embarrassing positions, for if the plain truth be told, the architect practically never pays for mistakes; the owner sometimes pays for them, while the contractor usually pays for them.

The first thing a foreman should do on receiving a roll of drawings is to look them over carefully to see if there are any practical difficulties which stand in the way of executing the work as proposed. He should also take the precaution to check the various lines of figures and make sure there are no discrepancies. In connection with this work the specifications should be read. If such a course is pursued, it enables the foreman to start the work with a clear idea of what is expected. In going over the drawings, a memorandum should be made of any discrepancies, omissions, or matters about which information is desired, and on the first opportunity which offers these matters should be talked over with the architect or his representative, when generally most of the questions which have arisen can be easily adjusted and explained. It is important, however, for the foreman to keep in mind the fact that it is out of his province, unless a special arrangement has been made, to make any changes which involve extras or allowances without first reporting the matter to his employer.

It may be the custom of some contractors to require all such transactions as have just been described to be done by the master builder in person; but as a rule, matters of mere detail, with the exceptions noted, can be settled in a perfectly satisfactory manner on the work. There is a disposition on the part of some architects and superintendents to ignore suggestions which are advanced by foremen, which, it is needless to say, is most short-sighted policy, but unfortunately practised to such an extent that many foremen, when asked why they did not call attention to some point in season to avoid trouble, reply that experience has taught them that the architect did not care to receive suggestions from their direction.

It is policy for the architect or his representative who superintends the actual construction of a building to say to the foreman at the beginning of a piece of work that there are two important things for him to remember; first, never to deviate from the plans and specifications without express permission; and secondly, if there is any point which is not fully understood or clearly shown, or if any work is shown or called for which he does not consider proper, he should invariably call attenion to the fact in time to have the matter remedied before any expense is incurred or harm done. If these simple suggestions are followed and the foreman understands that he is to work with the architect and not at cross purposes with him, many of the minor complications which ordinarily arise in building transactions will be avoided. Method and neatness are two qualities which should be cultivated by a foreman, for there is nothing which makes a better impression on both the owner and architect than to find that their work is being done under a well-defined system, and that the premises are always kept clean and free from an accumulation of rubbish. This also helps the contractor, for it is always possible under such conditions to advance the work rapidly, and with the least possible disorder and confusion.

It is particularly desirable for journeymen who wish to become foremen, and foremen themselves who have not had much experience, to make a special study of the trades other than their own which come in connection with their individual work, and it is excellent practise for such persons to take a course in draughting, which will enable them to thoroughly understand the drawings from which they are to lay out and execute their work. Such training was formerly given to a limited extent under the apprentice system, but since that has been abolished the learner is left to pick up the necessary information as best he can. With the development of night schools in the cities, however, there are ample opportunities for getting an elementary education in such matters, and it only needs the disposition to learn and some one (who can always be found) to direct intelligently the efforts of a beginner to enable a man to perfect himself in the theoretical matters which pertain to his trade, while at the same time he can be earning his living and gaining practical experience on the actual work.

LEGAL POINTERS.

A WORKMAN on a building, who fell and was injured by reason of stepping upon a joist which had just been sawed nearly through by another workman who had momentarily left it, cannot recover from his employer for such injury, on the ground that he should have been notified of the danger. — *Supreme Court, Massachusetts.*

AN architect who prepares plans for a building, and also superintends its construction, is entitled to a mechanic's lien for his entire services, but the preparation of plans alone, not supplemented with superintendence, does not give him a lien. It is the part the architect takes during the construction that draws his services within the lien law. And where only a portion of the work has been done, and the construction indefinitely suspended, the argument that the plans may be used eventually in the completion of the building does not assist the architect, for he never had a lien for his plans. — *Supreme Court, New York.*

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

NEW YORK.— The most important event of late has been the finishing of the preparation of the charter for Greater New York, its unanimous acceptance by the commission, and its presentation to the legislature, the result of which we are all anxiously awaiting, as it is sure to have an important effect in many ways on the future of the architectural and building interests of the great metropolis. Probably as soon as the matter of government is decided the question of a new city hall will be again agitated, for the need has become an absolute necessity. We trust that the competition will be as well conducted as the late unpleasant one *promised* to be.

Greater interest was taken this year in the annual exhibition of the Architectural League than ever before, not only among members of the profession, but by the public at large. The lack of ability on the part of ordinarily intelligent persons to intelligently criticize a work of architecture has been especially noticeable for years past. This condition of things can be, and in fact has been, materially improved by the admirable exhibitions given by the Architectural League in New York, and by kindred societies in other cities. The exhibition is particularly fine this year, and gives a very good idea of the amount of work in hand for '97, which is encouraging. The prospects are good; an unusual amount of large work has been announced during the past month. One item of interest, and we must say regret, to architects is the contemporaneous demolition of the two finest specimens of Egyptian architecture in this country, — the old Tombs Prison and the Bryant Park Reservoir. The old historic prison will give way to a new and complete building 186 ft. long, 45 ft. wide, and 123 ft. in height. It will have a capacity for eight hundred prisoners, and will cost $700,000. Withers & Dickson are the architects.

Bryant Park will be cleared of the reservoir and all existing buildings, and the entire block bounded by Fifth and Sixth Avenues

TERRA-COTTA CAP, POPE BUILDING, BOSTON.
Peabody & Stearns, Architects.
Made by Perth Amboy Terra-Cotta Company, Waldo Bros., Boston Agents.

and 41st and 42d Streets will be devoted to the use of a great public library to be erected by the city. It will be the home of the New York Public Library, and the Astor, Lenox, and Tilden Libraries. The city is to issue $2,500,000 in 4 per cent. gold bonds for the purpose.

The Grand Central Station is to be altered and improved at a cost of $500,000. Bradford L. Gilbert is the architect. Several stories will be added for offices, and the towers materially altered.

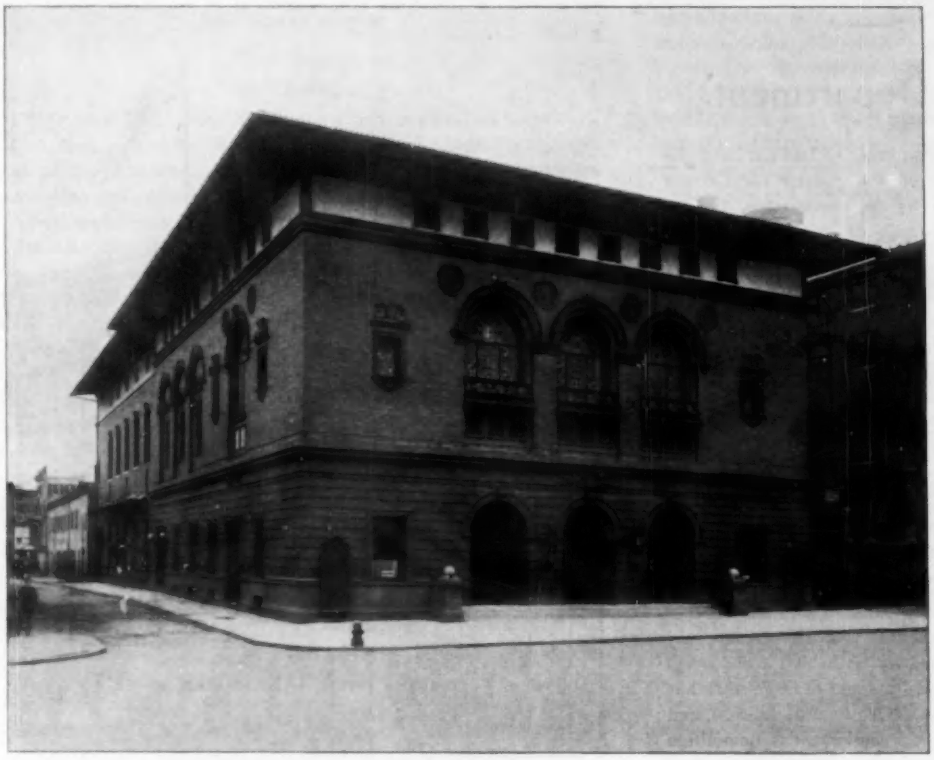
NEW POPE BUILDING, BOSTON, MASS.
Peabody & Stearns, Architects.
Gray terra-cotta furnished by Waldo Bros., New England Agents for Perth Amboy Terra-Cotta Company.

The new waiting room will be one of the largest in the world. It will be 200 ft. long by 100 ft. wide, and will front on 42d Street.

The Academy of Design has finally decided on a site for its new building. They have bought the entire east block front in Amsterdam Avenue, between 109th and 110th Streets. The plot has a frontage of 171 ft., and in each of the side streets 200 ft. The site is opposite that on which the Cathedral of St. John the Divine is to be erected, and is near the handsome new buildings of St. Luke's Hospital and Columbia University. A competition will probably be held, and we trust will result in a building which will be a credit to that part of the city, which promises to be most attractive architecturally.

Many new office buildings will be begun this spring, and all very close together, in the neighborhood of Wall Street. Among them are the Empire Building, by Kimball & Thompson; Exchange Court, Clinton & Russell; Washington Life Insurance Company, C. L. W. Eidlitz; Singer Machine Company, Ernest Flagg; office building for the Crocker Estate, by C. C. Haight; and the American Realty Company, W. B. Tuthill. A new custom house is contemplated, the committee still being undecided as to a choice between the Bowling Green site and the present site on Wall Street. A new hall of records is also being considered.

PHILADELPHIA.— In building circles there certainly is seen some substantial improvement at the present time over the condition of a few months ago, and there is on all sides the usual preparation for a brisk season; whether the work expected will materialize or not will remain to be seen, but there is expressed by some of the most extensive builders and operators the opinion that all signs must fail if there will not be a prosperous season. The demand for modern business buildings in the heart of the city is as strong to-day as it ever was, and it is probable that some of the projects mentioned last month will be carried to completion. The one for the large business and office building on the southwest corner of Broad and Chestnut Streets is being pushed forward with more than usual energy, and the present status in that case is that the adjoining property, No. 1408 Chestnut Street, now occupied by the Citizens' Trust Company, has been purchased by Messrs. Widener & Elkins, and will be added to the corner plot; the tenants, it is understood, are to vacate on or before the first of April next. The property as a whole will be offered to the Land Title & Trust Company at its next meeting, on March 22, and it is this company which proposes to put up the extensive building. A competition between several invited architects was held some few weeks ago by Messrs. Widener & Elkins, but up to the present time no statement as to the selection of an architect has been given.



HORTICULTURAL HALL, PHILADELPHIA.
Frank Miles Day & Bro., Architects.
Architectural terra-cotta made by Conkling, Armstrong Terra-Cotta Company.

Considerable advance has also been made in the restoration of the old State House at 5th and Chestnut Streets. It is proposed to restore the entire group of buildings, as far as possible, to their original condition. The interior has been practically finished, and the buildings have been formally turned over and accepted by the city; the lower portion of the main and the two wing buildings will now be restored, and the arcades which originally connected the buildings will be reproduced. Estimates for the work are now being asked by Architect T. Mellin Rogers, who has had charge of the work since its commencement.

Bids are now being asked for an eight-story "housekeeping apartment" building, which is contemplated on the northeast corner of 13th and Budd Streets; this will be one of the most complete buildings of its kind, and the conveniences are first class in every respect. The entire building will be strictly fire-proof, Fawcett floors being specified, and the walls of brick, stone, and terra-cotta. There is an elevator in the entrance hall, and a lift in the rear of the building, extending from the kitchens into the basement, where the janitor's apartments and the compartments of each of the tenants for coal, wood, etc., are located. Each apartment consists of a parlor, library, dining-room, two bedchambers, kitchen, servant's room, pantry, two storerooms, linen closets, etc., besides a liberal amount of hall space, and an arrangement with the front and rear vestibules which completely isolates each apartment from the entrance as well as from the adjoining one; there are two apartments on each story. The architects are Wilson Brothers & Co., Drexel Building.

Edward A. Cameron, of St. Louis, has been appointed, after examination under the Civil Service rules, to the position of superintendent of construction of the Philadelphia Mint; his name, it is understood, was at the head of the list of applicants, and he has been highly recommended for the position by leading architects of Chicago and Boston. The contracts for the basement and area walls will be let within two months, and during the summer the contracts for the entire superstructure, including the marble, brickwork,

TERRA-COTTA MEDALLION, HORTICULTURAL HALL, PHILADELPHIA.
Made by Conkling, Armstrong Terra-Cotta Company.

and structural steel, will be placed. The intention of Architect Aiken is to carry on the work without interruption to its completion.

CHICAGO.— A matter of considerable interest to architects has been the exhibition of architectural work from the American Academy at Rome, which Mr. Charles McKim is so wisely sending

TERRA-COTTA DETAILS, HORTICULTURAL HALL, PHILADELPHIA.
Made by Conkling, Armstrong Terra-Cotta Company.

on a tour from city to city. Mr. McKim is certainly entitled to the gratitude of the profession, on which this exhibition will exercise a beneficial influence, for his personal trouble and expense in thus exhibiting the scholarship work of prize winners. Mr. D. H. Burnham generously defrayed the expense of bringing the collection to Chicago. Three of the twelve men whose works make up the large exhibit are associated with Illinois institutions. S. G. Temple is an instructor in the Illinois State University, and Messrs. MacNeil and Fellows are both instructors in the Chicago Art Institute.

A matter of concern to Illinois architects just now is a bill before the legislature which, if it passes, will institute in this State examinations and license fees to regulate the practise of architecture.

Building news continues to be depressing. The number of permits taken out is increasing with the season, but they cover, for the most part, a cheaper class of buildings.

One Chicago-Philadelphia item is that D. H. Burnham & Co. have on hand a fourteen-story building, which is to be erected in the Quaker City.

Henry Ives Cobb has a large "out-of-town" building,— a savings bank at Albany, N. Y.

The underground Van Buren Street suburban station of the Illinois Central Railroad is now almost completed, and displays a very interesting variety of "burned earth" products. There are walls, floors, beams, arches, and columns covered with rough surface terra-cotta, hollow tile, variously colored glazed terra-cotta, enameled brick, and ornamental tiles. This list of finished work is varied with a considerable use of ornamental iron, marble, plaster, glass, and stone.

TRADE LITERATURE.

THE TIFFANY ENAMELED BRICK COMPANY, Chicago, have

TERRA-COTTA DETAIL, STEWART BUILDING, CHICAGO.
D. H. Burnham & Co., Architects.
Made by Northwestern Terra-Cotta Company.

condensed much valuable information into another attractive little pamphlet, which treats in an interesting and instructive manner the uses and purposes of enameled brick. This book should be at the right hand of every one who contempletes employing this material.

WE have received a very attractive pamphlet issued by James A. Davis & Co., sole New England agents of the Alpha Portland Cement. It contains a number of illustrations of buildings, dams, and bridges in the construction of which Alpha Portland Cement was used exclusively; also a number of letters from prominent authorities indorsing the superior merits of this cement.

Copies of this book will be found very interesting, and may be had by applying to James A. Davis & Co., 92 State Street, Boston, Mass.

WE have received the recently published illustrated catalogue of fire-proof building material as manufactured by Henry Maurer & Son of New York. The fire-proofing products of this house are so well

STEVENSON BUILDING, INDIANAPOLIS, IND.
Henry Ives Cobb, Architect.
Built of gray brick and terra-cotta. Brick furnished by the Columbus Brick and Terra-Cotta Company and the terra-cotta by the American Terra-Cotta & Ceramic Company.

known, and have so strong a hold on the good-will of the building community, as to require very little comment on our part. There are one or two features introduced in the catalogue which are novel and interesting. One of these is the 2-in. Phœnix fire-proof hollow tile partition, which is made of hollow burnt clay or porous terra-cotta tiles, set on edge, with a long strip of band iron imbedded in cement or mortar between the courses, giving to the 2-in. partition the same tensile strength as a wall 4 or 6 ins. thick. The catalogue also illustrates the forms of hollow brick which are made to be used as bottle racks, which is somewhat of a novelty in its line. There is also illustrated the Eureka system of hollow tile floor construction, which comprises three tiles, two skew-backs which fit the beams, and one center or key tile, forming a flat ceiling of floor requiring no centering during the erection, which can be put in rapidly with or without the use of cement, as the tiles cannot work out or get

loose in any manner. In addition there are the standard shapes manufactured by this company, together with reports of tests, etc., and many very valuable suggestions as to fire-proofing methods.

THE pamphlet recently issued by Fredenburg & Lounsbury, Metropolitan Building, New York, sole agents in New York and New England for the Hydraulic Press Brick Companies, contains a concise and splendidly arranged description of the various structures erected of the Hydraulic Press Brick during the years 1895 and 1896, together with mention of color and shape of brick, character of trimming of the buildings, and the names of the architects and builders.

TERRA-COTTA CAP, Y. M. C. A. BUILDING, NEW YORK CITY.
Parish & Schraeder, Architects.
Made by Excelsior Terra-Cotta Company.

The book has been carefully compiled with a view to making it particularly serviceable to an architect desiring to adopt a shade of brick different from those he is accustomed to employ. By consulting its contents, he can ascertain the location and general character of the buildings wherein a particular brick in which he is interested has been used, and he is then in a position, if he so desires, to make a systematic inspection of the work in question, and see the various shades in actual use, in buildings of varied designs, and note the effect of same with the several combinations of stone, terra-cotta, etc.

We can commend Messrs. Fredenburg & Lounsbury on the general good style and character of their contribution to trade literature, and are glad to recommend it as being of real interest to those engaged in the building profession.

OF INTEREST.

WALDO BROS. have closed a contract with Hootons & Hemmenway, of Providence, for furnishing the terra-cotta for the new building for the William F. Low estate, Westminster Street, Providence.

THE Celadon roofing tiles have been specified for the Municipal Building, Yonkers, N. Y., E. A. Forsythe, architect. Also for the residence for Phillip Kleeburg, Esq., New York City, H. P. Gilbert, architect.

THE UNION AKRON CEMENT COMPANY, of Buffalo, are furnishing their Akron Star Brand of cement for the new building of the Brooks Locomotive Works, at Philadelphia, and also for the Willard State Hospital, at Willard, N. Y.

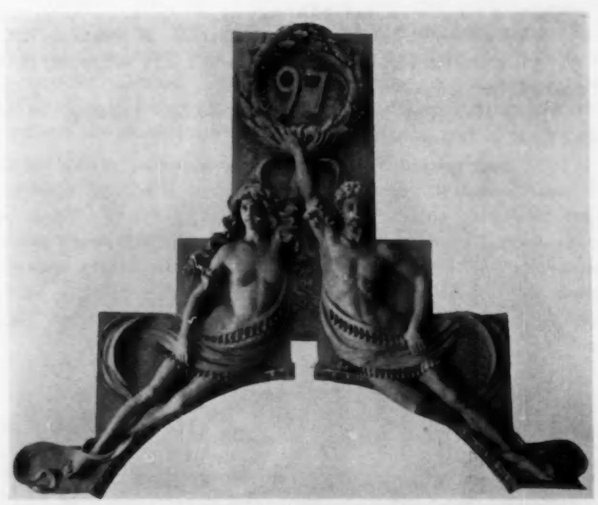
WALDO BROS. will furnish the terra-cotta roof tiles for the Newton Bank Building, Newton, Mass. They will be a very rich dark-red glaze, making a pleasing contrast with the rest of the building.

IN the February BRICKBUILDER, under the illustration of the Y. M. C. A. Building, it was stated that the brick for the building was furnished by the Excelsior Terra-Cotta Company. The statement was incorrect, the terra-cotta only having been furnished by the Excelsior Company. The Raritan Hollow & Porous Brick Company, New York City, furnished the gray brick used.

THE NEW CENTRAL HIGH SCHOOL BUILDING, of Detroit, is a structure of which the citizens of that city are justly proud. The utmost care has been used in constructing the building on the most approved lines, and under most up-to-date methods. The building is faced throughout with pressed brick, and the Board of Education, having the matter in charge and adopting the Morse Patent Wall Ties for bonding the same, realized that, considering every feature, this was the most approved form of bonding in use. That they were entirely satisfied with the result is conclusively proven as the ties were also used for the same purpose in the construction of the Delray School Building and Lysander School Building, of the same city. Attention is called to the illustration of the Central High School Building, on page xxxvi.

THE MATAWAN TERRA-COTTA COMPANY is the name of the new corporation which has succeeded the firm of K. Mathiasen & Co. This firm has, until the later part of last year, been doing business at Trenton, N. J., in a leased factory; but with the growth of the company this factory had become inadequate for the amount of business done, and it was decided to move the works to Matawan, where the large pottery and brickmaking plant formerly known as the I. S. Rue Pottery was secured. This plant, with its machinery and four large kilns, is admirably fitted in every respect for the manufacturing of architectural terra-cotta.

The Matawan Terra-Cotta Company is composed of all the old members of K. Mathiasen & Co. Karl Mathiasen, the president and general manager, has been known for many years in the terra-cotta field as a successful manufacturer of architectural terra-cotta. He is also the president and general manager of the New Jersey Terra-Cotta Company, of Perth Amboy, N. J. The other members of the company, the Eskesen Bros. are well known throughout the terra-cotta trade as enterprising and progressive business men.



TERRA-COTTA DETAIL, BUILDING FOR WM. WEIGHTMANN, PHILADELPHIA.
Willis G. Hale, Architect.
Made by Standard Terra-Cotta Company.

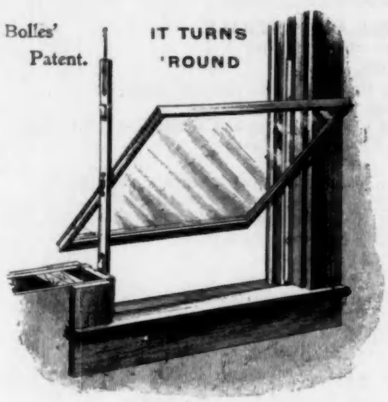
The Boston agents of this concern are G. R. Twichell & Co., 19 Federal Street.

A MEETING of the Philadelphia Brick Manufacturers' Exchange was recently held in the Master Builders' Exchange, when a scale of

prices for brick during the ensuing year was formed. The meeting was attended by the members of twenty firms in that city, representing three fourths of the brick manufacturing interests of the vicinity. The scale agreed upon places the price of salmon brick at from $5.50 to $6 per thousand; hard brick, $7 to $8; stretchers, $9 to $13; pressed brick, $17 to $19, and pressed stretchers, $12 per thousand for the average haul. The brick production for the past year was about 400,000,000, a decrease of about 40,000,000 over the preceding twelve months, caused by some of the yards becoming exhausted and the firms owning them going out of business.

A NEW REVOLVING SASH.

IN every large city there occurs each year a number of fatalities through the operation of cleaning the windows of the large buildings from the outside, and we are glad to call the attention of our readers to the Bolles Sliding and Revolving Sash, as being a device which will eliminate all such danger and render accident from this cause an impossibility.



This window is so constructed that both sides of it may be cleaned from the inside. It can be revolved, reversed, or placed at any desired angle whatsoever for the purpose of ventilation, besides sliding up and down the same as any ordinary sash. To turn the window, reverse it, or place it in a slanting or horizontal position, all that is necessary to do is to raise the sash slightly, and then push the bottom rail outward.

In order to obviate all possible rattling and to render the sash both wind and dust proof, a special device is attached to each end of the strips which press firmly against the window jamb. The sash is snugger and closer fitting by far than the old-style sash, and runs with equal ease and smoothness. The joint is self locking.

The upper sash is similarly constructed as the lower, and both sashes may be turned either way, separately or together.

The patentees call particular attention to the following important points: Its simplicity, the entire absence of complicating mechanism, the fact that it can be hung with as great ease as the old-style sash, its low price, and the doing away with all the dangers incident to the cleaning of windows.

Further information in this matter may be obtained from Edward Diggs, General Agent, Builders' Exchange, Baltimore, Md.

FOR SALE.

TWO COMPLETE OVER-GEARED 8 FT. DRY PANS, WITH 48-IN. PULLEYS, ENTIRELY NEW.

FOR PARTICULARS INQUIRE OF SMITH & CAFFREY, SYRACUSE, N. Y.

AGENCY WANTED.

A GENTLEMAN having well-located office in Boston would handle some building specialty as side line; is in thorough touch with building work throughout New England, and has good acquaintance among architects and builders. Would prefer something in fireproofing or structural work. Address, SPECIALTY, care THE BRICKBUILDER.

Houses Can Be

made much more attractive by the use of our

Fireplace Mantels made of Ornamental Brick.

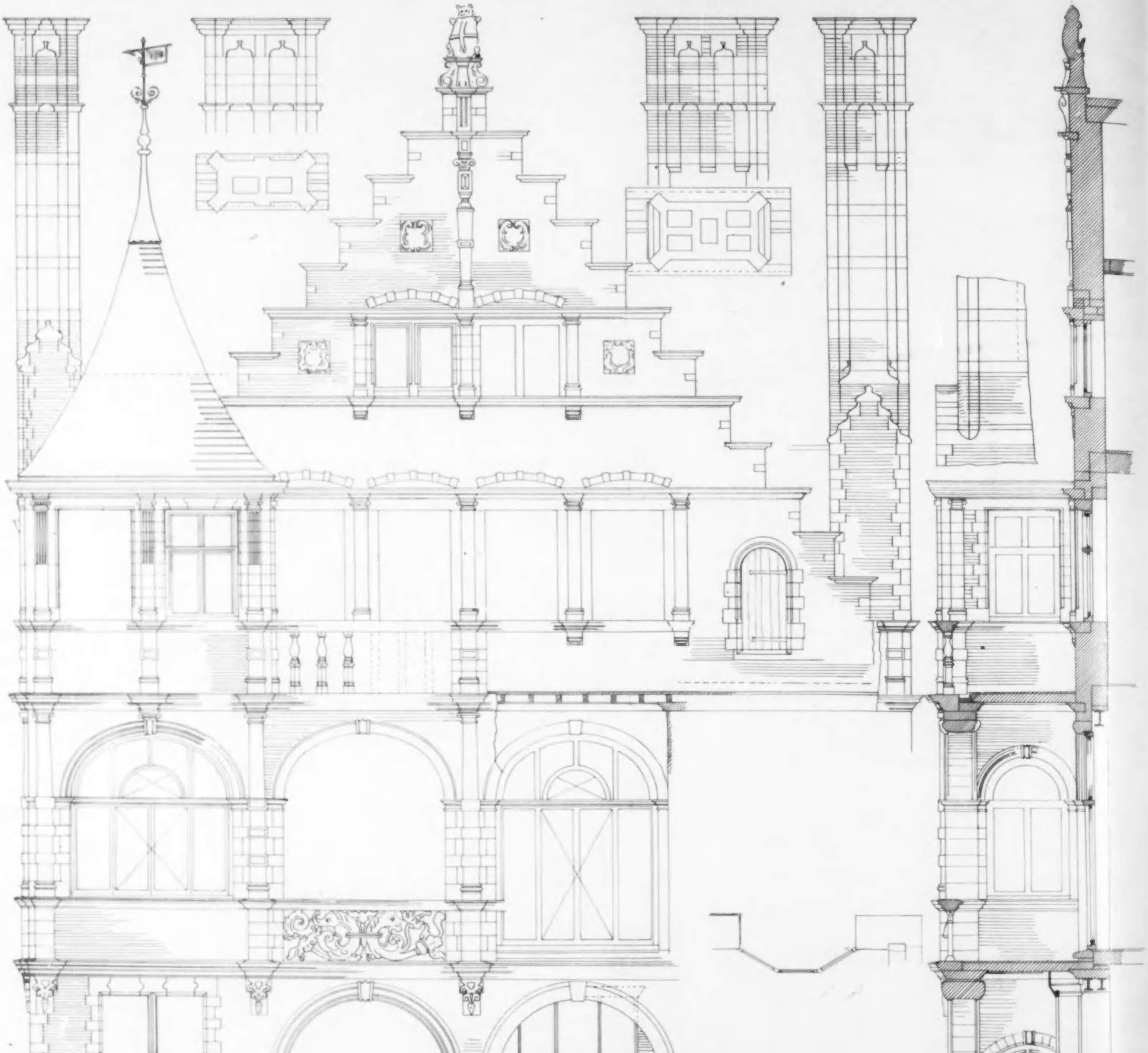
There is no other kind of mantel that looks as well as ours. No others have those soft effects of coloring so restful to the eye. No others show such a perfect combination of richness, simplicity, and harmony. None so durable and substantial. Ours, when completed, bring forward the thought that nothing else could fill the space so well and so appropriately. And yet they cost no more than other kinds, and any good brick-mason can set them up from our plans.

These pictures are only suggestions. Our Sketch Book describes and illustrates 52 designs of various colors, costing from $12 upwards. Send for it.

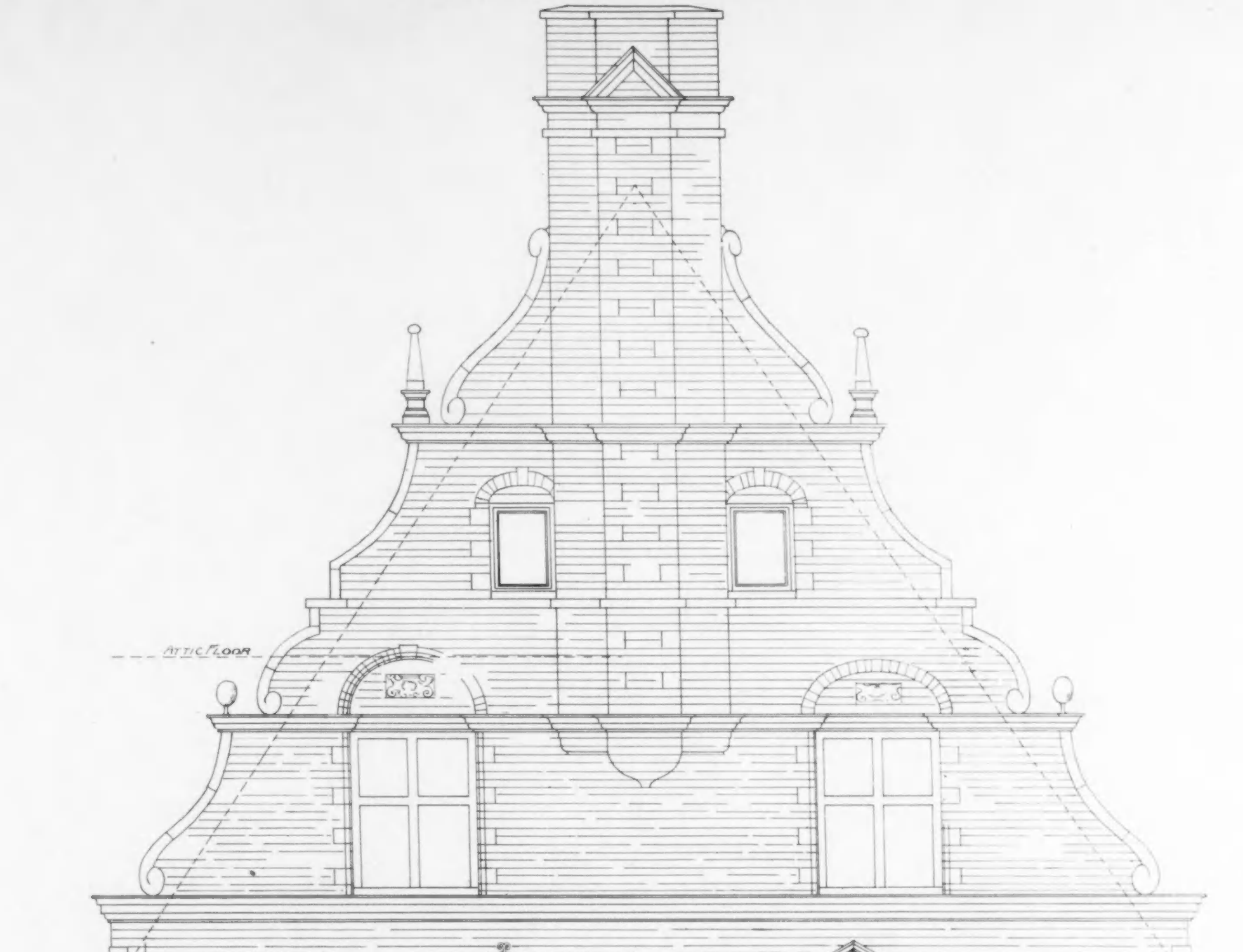
PHILA. AND BOSTON FACE BRICK CO.,

15 Liberty Square, Boston, Mass.

INDEX TO ADVERTISEMENTS.

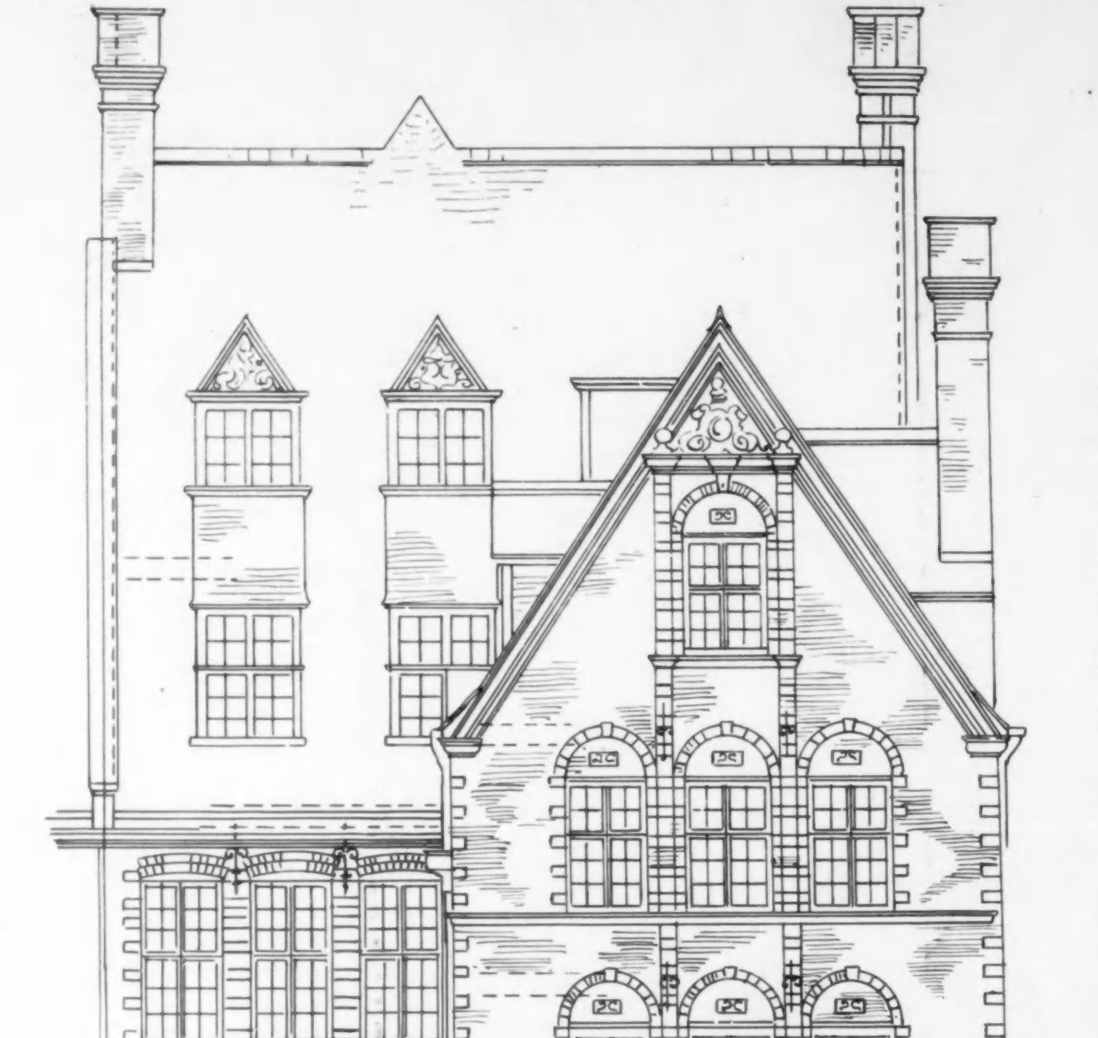


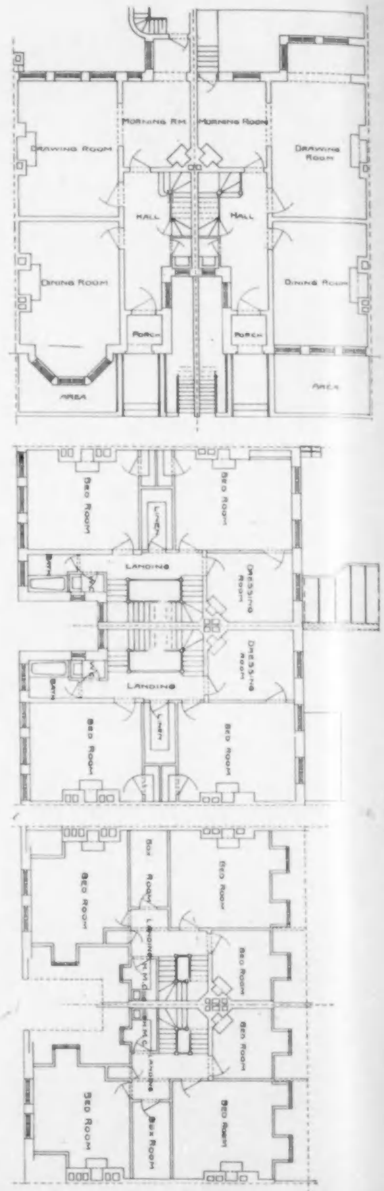
DETAILS OF RESIDENCE, COLLINGHAM GARDENS, LONDON, ENGLAND.
ERNEST GEORGE & PETO, Architects.



DETAILS OF RESIDENCE, HARRINGTON GARDENS, LONDON, ENGLAND.

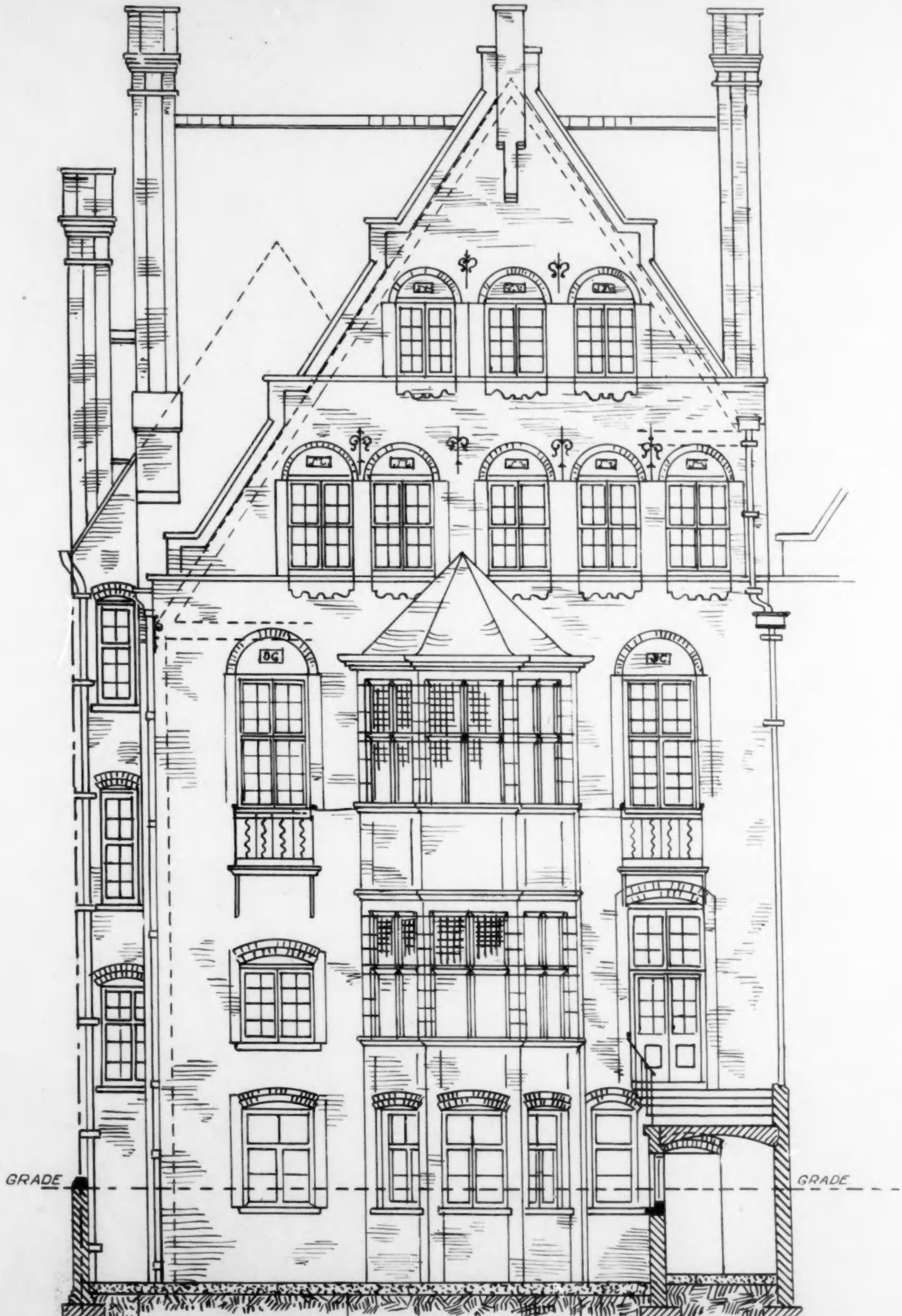
ERNEST GEORGE & PETO, ARCHITECTS.





FLOOR PLANS OF
RESIDENCES SHOWN ON
PLATES 29 AND 30.

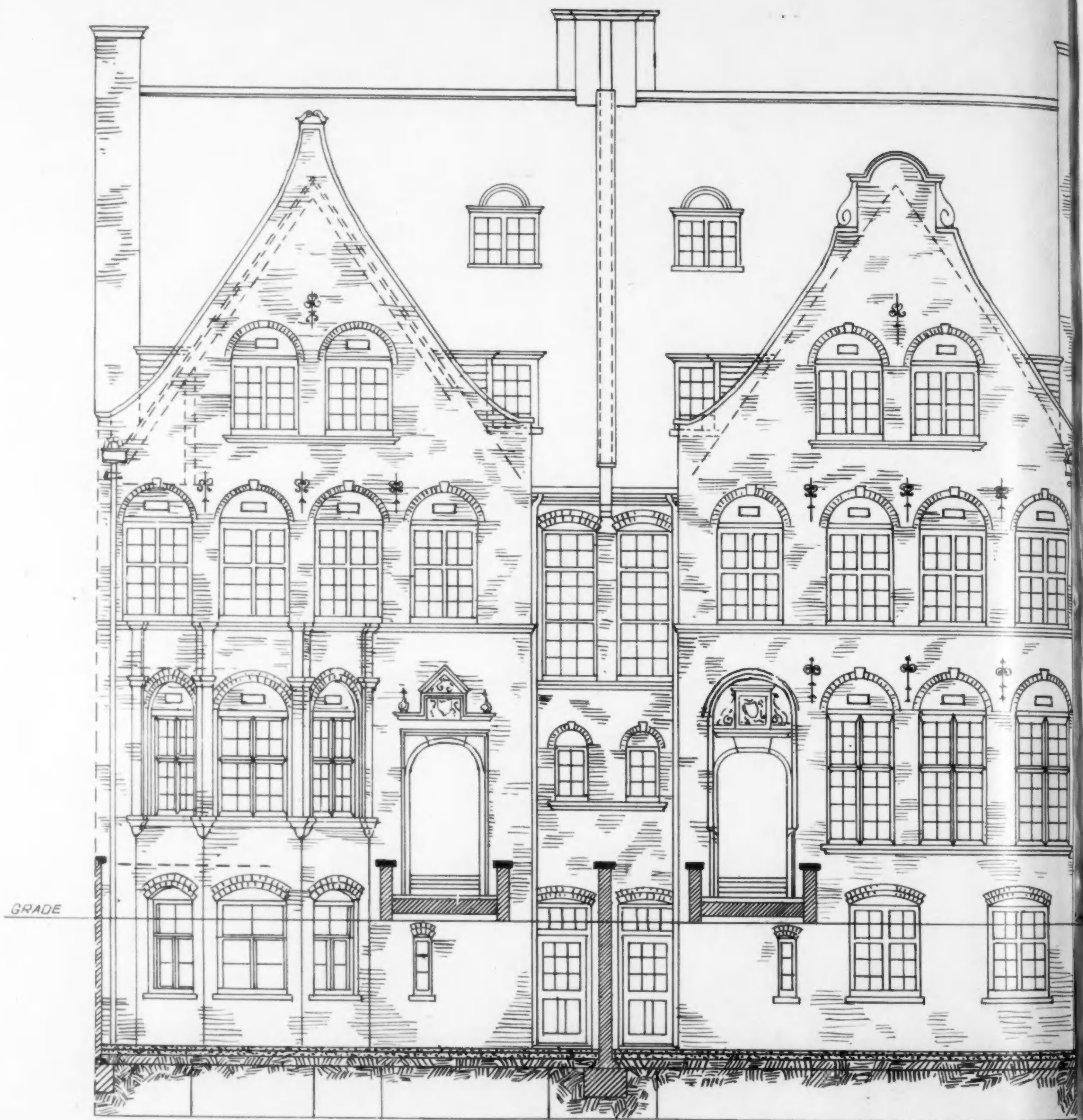
FRONT ELEVATION.
RESIDENCE, COLLINGHAM GARDENS, LONDON, ENGLAND.
ERNEST GEORGE & PETO, ARCHITECTS.



BACK ELEVATION.

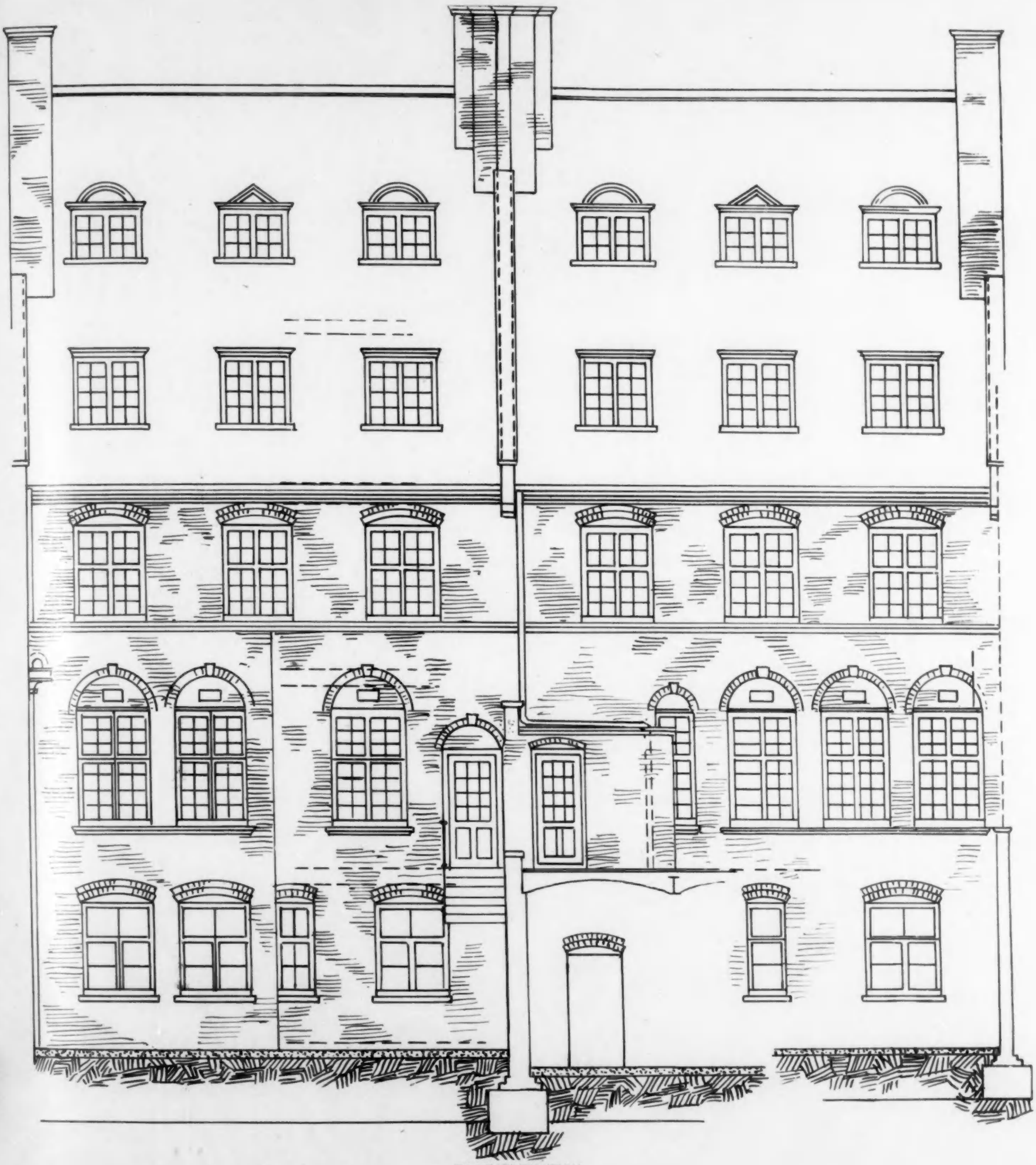
RESIDENCE, COLLINGHAM GARDENS, LONDON, ENGLAND.

ERNEST GEORGE & PETO, ARCHITECTS.



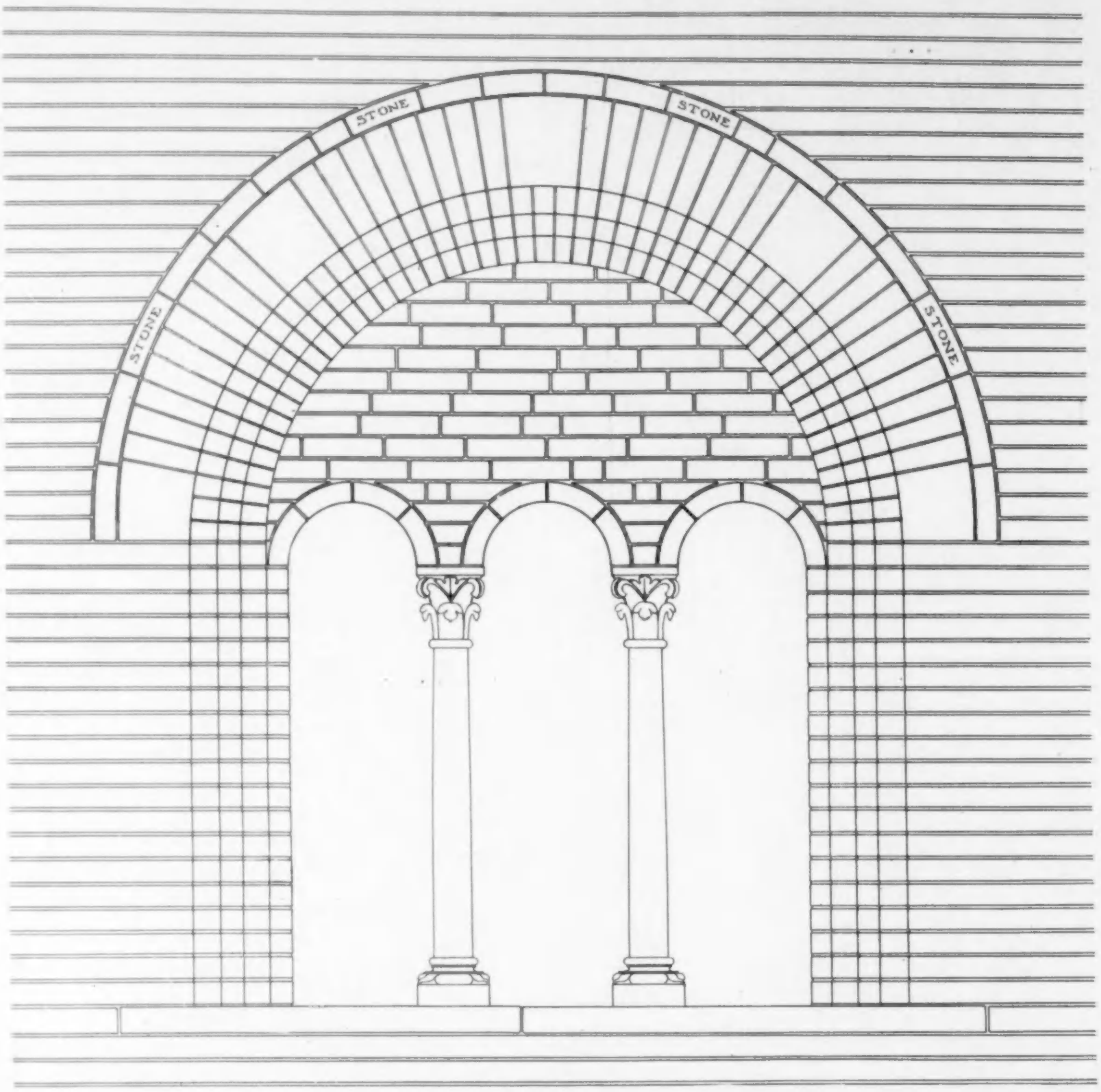
FRONT ELEVATION.

RESIDENCES, COLLINGHAM GARDENS, LONDON, ENGLAND

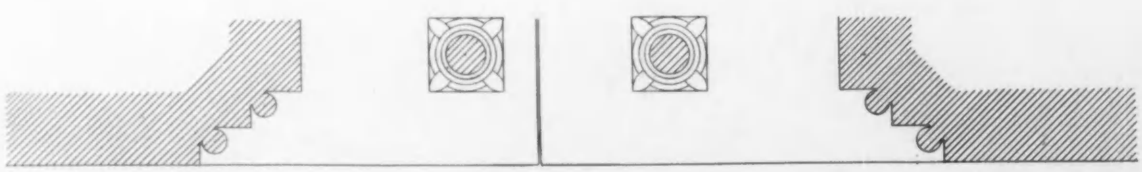


BACK ELEVATION.

LONDE NGLAND. ERNEST GEORGE & PETO, ARCHITECTS.



ELEVATION

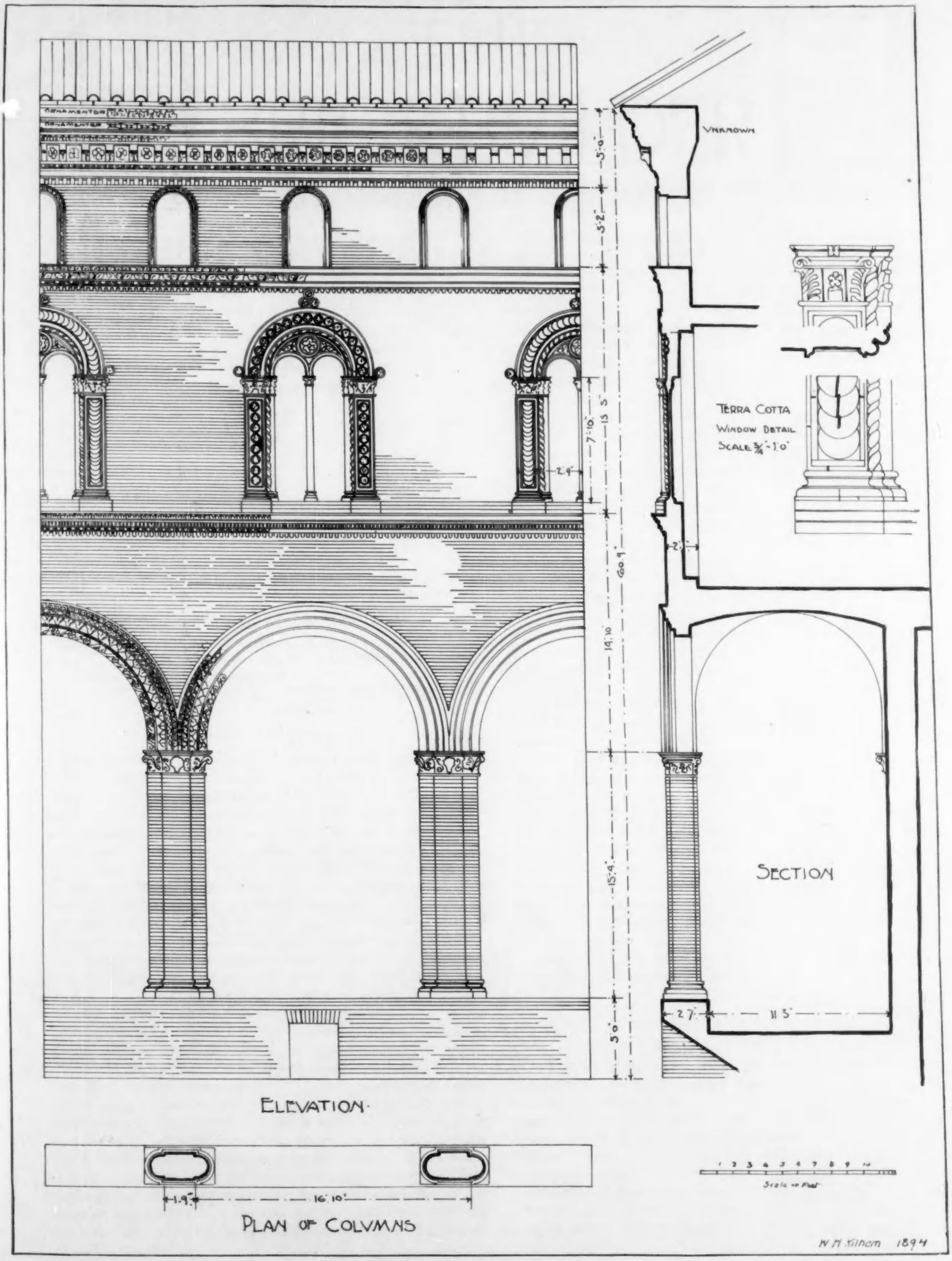


PLAN

SCALE

NOTE. Voussoirs Brick and Sandstone.
Columns and Sill Stone.
All other Work not marked differently, of Brick.

MEASURED DRAWING OF WINDOW IN SOUTH SIDE OF MUNICIPIA, MONZA.
THIRTEENTH CENTURY.



PALAZZO FAVA, BOLOGNA.

MEASURED AND DRAWN BY WALTER H. KILHAM, ROTCH SCHOLAR.